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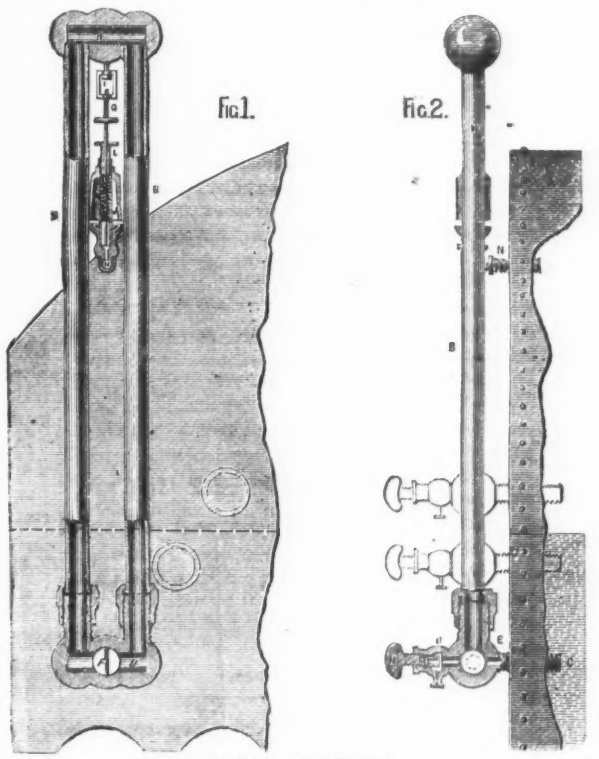
Low Water Detector.

In view of the serious boiler explosions which are continually occurring, and which so often arise from low water in the boiler, we are glad to learn that our Western people are waking up to the great necessity of the day, by applying to their boilers an automatic safety gauge or alarm, which, as often as it has been tested has not failed to work with entire satisfaction. As a general thing automatic safety arrangements are condemned—but the "Massey low water alarm" has proved by its simplicity and accuracy that it cannot fail—while the engine driver may prove incompetent, unfaithful, or be deceived. The apparatus consists of two tubes of brass placed parallel to each other and connected at top and bottom, which enables them to be tested and cleaned of any scale or deposit of sediment. It can be tried at any time to insure its being in working order, and in every instance where low water has occurred in boilers with this attachment, it has not failed to blow the whistle and give the alarm.

The tubes are so arranged that when the water falls below the point of their lower connection with the boiler, it is expelled from them, and the hot steam taking its place heats and expands the brass tubes sufficiently to force open a valve and blow a whistle, which alarm continues until the proper water level is again restored in the boiler.

The accompanying engraving shows very fully this simple arrangement. Fig. 1 is a front view as applied to a horizontal boiler, and Fig. 2 is a side view of the same, showing the gauge cocks and steam connections. BB a double tube of brass, F a chamber or iron tube forming a steam and water connection with the boiler, N, steam connection with the whistle, J hollow spindle through the whistle, K, small spiral spring to hold the valve in its seat, L, screw for adjusting steam whistle to any desired pressure, so that an alarm can be blown for an excess of steam pressure—G the valve-rod, and I the swivel for adjusting for low water.



LOW WATER DETECTOR.

It will be seen that when the water in the boiler and chamber is above the lower gauge cock, the steam communication with the expanding part of the detector is submerged and both tubes filled with water, the temperature of which is not sufficient to materially expand the tubes.

The Detector is adjusted to suit the steam pressure, and should the water in the boiler descend below the lower gauge cock, steam will immediately enter one of the tubes B, expelling the water through the opposite tube into the boiler. The metal expanding raises the valve and sounds the alarm.

It is thought that such an instrument attached to boilers will tend to make engine drivers and firemen careless. We are inclined to think this a mistake, and that the fear of exposure by the alarm would make them more attentive and cautious.

Indiana Coal.

To the Editor—Sir: In your issue of April 2nd you published an excellent paper from the pen of S. H. Daddow on the subject of Blast Furnace Fuel. May I have permission to correct a mistake which the writer makes by inadvertence, I presume? After stating the general rule that "the out-cropping coal of B in all bituminous localities, partakes more of the caking or coking quality than the coal of the same bed in the interior of the same basins," he proceeds to instance the localities where rivers have cut deeply into the coal measures. Among these he names Brazil, in Indiana. Now the topography of the Brazil coal-field is exactly the reverse of this. The Brazil furnace, the Planet, the Knightsville and the Lafayette furnaces, are located along the line of a watershed, between the tributaries of White river and the Wabash—neither of them being more than a mile from the actual summit. The coal of B, not only in this vicinity, but along its whole line of outcrop from Cannelton on the Ohio river to the Illinois line, a distance of 150 miles in the State of Indiana, preserves its peculiarity of a dry burning coal. Perhaps the most bituminous coal found on the whole line is at Cannelton, where the Ohio river exposes it at a depth of some 300 feet. At no place in Indiana have I observed the peculiarity alluded to by Mr, Daddow, though I think it is generally true in the Kentucky and Virginia fields.

A peculiarity which marks the bed B in Indiana, is worthy of note as furnishing probable data to determine Mr. Daddow's theory of the persistence of this bed under Central Illinois. The thickness of coal is greatest at the eastern outcrop, and as the bed descends in its westward dip, at the rate of about twenty feet per mile, the coal grows thinner without material change in its quality. At Planet furnace and at Knightsville, the bed has a thickness of from four and a half to five feet, while at Brazil, five miles west, it measures from three to three and a half feet, and is reached at about 100 feet below the surface. By borings made at Terre Haute, 16 miles west of Brazil, the coal bed B was cut at a depth of 300 feet, where its thickness was only 28 inches. At this rate of thinning it would entirely disappear within twenty miles from the eastern line of Illinois.

The micaceous sandstone overlying B is very persistent, and may generally be relied on as evidence of the coal below. The bed B is often divided into two members, the lower of which is usually the thicker member and furnishes the purer coal. Exceptions to this rule frequently occur, as for example at Carbon city, on the Indianapolis and St. Louis R. R., where a shaft 50 feet deep exposed a bed of block about 5 feet thick, but 10 feet below this was found a bed of 3 feet thick, of nearly the same quality of coal as the upper bed.

Though the extent of the bed B may not equal Mr. Daddow's anticipations, yet the supply of this dry burning coal in the western coal-field is much greater than furnace men generally suppose. Even if the rule of thinning by dip, to which I have alluded, be confirmed, still Indiana alone will have more than 3000 square miles of coal bed B of workable thickness.

R. T. B.

Amalgamation of Silver Ores in Pans, With the Aid of Chemicals.

[Conclusion.]

The following table will show results obtained in working on a large scale two different lots of slime.

1° Slimes from various mills.

2° Slimes from Savage ore.

No.	Assay value per ton			Yield per ton		
	Gold	Silver	Total.	Gold	Silver	Total.
1.	7·28	22·44	29.72	4·01	20.20	24·21
2.	6·03	35·70	41·73	4·60	31·08	35·68

No.	Per cent. extracted			Fineness of bullion		
	Gold	Silver	Total.	Gold	Silver	Total.
1.	55·08	90·01	81.46	005	401	406
2.	76·28	87·06	87.35	005	537	542

The results obtained in the working of lot No. 2 are somewhat above the average, which can be estimated at about 80 per cent. of the assay value.

The method of treatment now in vogue is susceptible of modification and improvement. The yield can be increased by charging the chemicals at two different periods, say 2-3 at first and the remaining third two or three hours later. This is due to the

fact that the action of the chloride of copper becomes more feeble as time elapses, and is revivified by the addition of this second portion.

A saving in the amount of salt consumed can be effected by dissolving it together with the sulphate of copper in vats in proportions approximating to their chemical equivalents, and charging the resulting chloride of copper in the liquid state. The plan of putting the sulphate of copper and salt into the pan separately, necessitates a large excess of the latter to ensure the complete decomposition of the former. An excess of salt was originally deemed advantageous on the supposition that it would act beneficially in holding the chloride of silver in solution. thus presenting more surfaces of contact to the action of the quicksilver, and moreover would convert the Hy Cl formed to Hy Cl^2 in which state it would be precipitated by the iron of the pans in the metallic state. It is, however, improbable that such reactions should occur on a large scale where the reagents represent so small a proportion of the entire mass.

The discovery of a cheap method of working slimes led to important results. The same process was soon applied to the working of low grade tailings of which vast quantities had accumulated on the plains bordering on the Carson river, at Dayton, and at other points, Several mills, with a capacity of working from 250—300 tons per diem each, are now in operation in Dayton and vicinity. The tailings which were formerly allowed to run into the Carson river, are now carefully saved, and in fact to such an extent has the reaction set in against the wasteful practices of the past, that many mill owners save the tailings after they have passed through the pans with a view to reworking them at some future time. The tailings being mostly very poor it becomes necessary to work a large amount daily in order to obtain a fair interest on the capital invested. This is effected by using very large pans and by rapid amalgamation. Economy in the time devoted to amalgamation cannot, however, be effected without sacrificing a portion of the precious metals which might otherwise be saved. It is, however, considered policy to suffer this loss. The method of treatment is practically the same as in working slimes, with the exception that a smaller proportion of sulphate of copper and salt is used, and that in other respects less attention is paid to the extraction of a high per centage, the value of the tailings not justifying too careful a manipulation. For the same reason the extra expense of grinding the tailings which would undoubtedly increase the yield, is dispensed with.

As a rule the bullion produced is very base, not exceeding on the average 450-1000 and often going as low as 350-1000.

In the mill of BIRDSALL & Co., in Dayton, where the crude bullion rarely exceeds in fineness the latter figure, an inexpensive process has been adopted for partially refining it.

As the bullion comes from the retort a great portion of the copper is found in a crust on the surface of the slab. This slab crust which contains some silver and gold, is separated from the finer metal beneath, and the latter is cast into bars 500—600 fine. The cupreous crust is roasted in a reverberatory furnace and crushed, and the copper oxide separated by means of sulphuric acid. The bullion from other mills is sold in the crude state and suffers a discount proportionate to its baseness.

Even with the use of sulphate of copper and salt the percentage extracted from low grade tailings rarely exceeds 50 to 55 per cent. This is due principally, as above stated, to the necessity of an economical, rapid, and consequently imperfect treatment. The same tailings, however, worked without chemicals but otherwise in the same manner, would not yield over 20 to 25 per cent. of their value, and in some cases not that much.

Richer tailings give better results and are also treated more carefully.

In a mill of large capacity and in good working order the cost of working does not exceed $3 to $4 per ton. Hence there is still a margin for profit on tailings assaying only 9—10 per ton. The pans now almost universally in use in the Washoe tailing mills have a capacity of from 6—8 tons, and the time of working the charge generally does not exceed four hours. More than half an hour, however, is consumed in charging and discharging, in heating the pulps, etc. The actual time of treatment therefore, is less than three and a half hours.

The following table will show the amount extracted from one half hour to one half hour, from a charge of tailings assaying $15 31 per ton, worked in a pan of eight tons capacity.

Value of tailings, $15 31.

	Silver.	Yield P.T.
Assay value of sample from pan, end of 1st ½ h.	12·40	2.91
" " " " 2d ½ h.	11·70	·70
" " " " 3d ½ h.	10·83	·87
" " " " 4th ½ h.	9·58	1·25
" " " " 5th ½ h.	9·02	·56
" " " " 6th ½ h.	8·09	·93
" " " " 7th ½ h.	7·85	·24
" " " " 8th ½ h.	7·77	·08
		7 54

Total percentage extracted, 49·30 per cent.

The falling off in the yield in the 7th and 8th half hours, is due to the insufficiency of chemicals used, their action having spent itself in the earlier part of the treatment.

Until the introduction of the use of sulphate of copper and salt, the working of tailings was confined to rich lots where a small percentage of the value would still prove remunerative, and to blanket concentrations. The richness of the latter consisted to a great extent in amalgam, and its successful extraction was consequently an easy matter.

Before dismissing the subject of slimes and tailings, it is necessary to refer to certain classes of these ores which do not yield to the action of sulphate of copper and salt to the extent claimed in the foregoing pages. The precise cause of this rebelliousness has never been acurately ascertained, but from the fact that the bullion produced in working them is always of exceeding fineness (990-1000 and over) even when a large excess of sulphate of copper is used, it is evident that the evil consists in the presence of some substance which decomposes the sulphate of copper, thus producing the same effect as if none were used. This injurious agent is probably an alkali or alkaline earth. It is to be regretted that we have no knowledge of any cheap chemical reagent producing practically the same effect as chloride of copper, and which would not be subject to this decomposition. The following table will show to what extent the treatment of slimes is affected by the elimination of the copper salt ; 562¼ tons of slimes from Chollar ore were worked in charges of 2500 pounds each, with 15 pounds sulphate of copper and 30 pounds salt to the charge.

Total amount worked 562¼ tons.

	Gold.	Silver.	Total.
Value per ton.....	$ 12 60	$ 30 91	$ 43 51
Total Values.....	$7084 35	$17379 14	$ 4463 49
Yield.....	$1651 16	$ 6200 93	$ 7852 09
Per centage extracted	23 30	35 68	32 97

	Gold.	Silver.	Total.
Fineness of bullion	016	980	996
	1000	1000	1000

Within half an hour of putting the sulphate of copper into the pan, chemical tests could not detect the presence of copper in solution in the pulp, thus proving that it had been almost immediately decomposed.

The same phenomenon has presented itself in the working of tailings.

Such cases, however, are exceptional, but prove why in certain instances the use of sulphate of copper and salt may not produce the effects claimed for it. Apart from these exceptional cases the beneficial effects of chloride of copper being thoroughly established, the question naturally arises why its use is principally limited to the working of slimes and tailings and why it is not more generally employed in quartz mills. There is not the slightest doubt that an intelligent use of chemicals would prove highly beneficial in many cases where the old method of treatment without chemicals is adhered to. The ores of the Comstock ledge are particularly docile under their influence. It is true that many millmen claim to have investigated the matter and have pronounced against the use of chemicals, but as has already been stated their experiments were carried on in such an unfair manner that failure was inevitable. It could not be expected that a few ounces, or even a few pounds, of sulphate of copper and salt would produce appreciable results upon a ton of ore, and yet millmen were deterred from using larger quantities through the fear of producing baser bullion. It is a common superstition that fine bullion is a guarantee of skillful amalgamation, than which nothing is less true. Until this prejudice is eradicated it is useless to look for the employment of sulphate of copper in quartz mills in quantities sufficient to establish its merits. Another cause of indifference on the part of Washoe millmen is the fact that they generally find no difficulty in returning by their present method of working 65 per cent. of the value of the ore, the amount universally guaranteed by custom mills. and are, naturally enough, not disposed to increase the cost of working without corresponding benefit to themselves. The mine owners also appear to be satisfied with these results, but their apparent indifferenee to their own interests does not admit of so simple an explanation.

The first quartz mill to adopt the use of sulphate of copper and salt was that of the Meadow Valley Co. near Pioche, Nevada. This mill commenced operations in the summer of 1870. Owing to a misunderstanding only a small supply of sulphate of copper was on hand at the time, and when this was exhausted the difference in percentage extracted was immediately apparent. During the first week's run, the yield was equal to 80 per cent of the value of the ore. When the chemicals were exhausted the yield fell below 40 per cent., only to recover on the receipt of a fresh supply of sulphate of copper. The following table will show the difference in percentage extracted whilst working with and without chemicals :

July and August, 1870—Percentage extracted, 54.40, working three-quarters of the time without chemicals.
September—64.30, working one-half the time without chemicals.
October—87.90, working with chemicals.
November—82.5, working with chemicals.
December—81.8, working with chemicals.
January—76.7, working with chemicals.
February—77.6, working with chemicals.
March—68, working with chemicals.
April—67, working with chemicals.
May—74.4, working with chemicals.
June—74, working with chemicals.
July—73, working with chemicals.

Average assay value of the ore for the year $143.21.

The ores operated upon were very rich. In such cases the policy of working ores with chemicals in preference to roasting may be questioned.

The matter must be decided by a careful comparison of the expense and results of the respective methods. It must furthermore be taken into consideration that roasting involves dry crushing, and consequently a decrease in the working capacity of a mill of a given number of stamps. This again necessitates a larger outlay for the erection of more mills in order to crush a sufficient number of tons per diem to render possible the payment of any considerable amount in dividends. The expense of building furnaces, etc., must also be taken into consideration. Should, however, the ores prove of so rebellious a nature that the difference in percentage extracted by the roasting process be sufficient to overrule these considerations, then it is evident that the wet process must give way to dry crushing and roasting.

At the Nevada Beetle mill, where this method of

working with chemicals was introduced during the past summer, it was absolutely necessary to find some means of reducing the ore without roasting as it was not sufficiently rich to admit of the latter method of treatment. Here also it was found that whereas only 35 per cent. of the value could be extracted by quicksilver alone, the use of sulphate of copper and salt increased the value to 75 per cent. and upwards. These ores contained still more lead than those of the Meadow Valley mine, and finally became so bare as practically to belong to the class of smelting ores, causing an enormous loss of quicksilver and rendering their beneficiation by the amalgamation process an impossibility. The enterprise had therefore to be abandoned.

The only chemicals thus far known to be applicable to the amalgamation process are salts of copper. A great benefit would be conferred upon the mining public by the discovery of other chemicals equally effective but less expensive and not so subject to decomposition by the iron of the pan or by the ore itself.

The Adaptability of Titaniferous Ores for the Production of Iron by known Methods.*

By G. W. MAYNARD, M. E.

It is proposed in the following paper to sum up the published accounts of experiments that have been made with titaniferous ores, with the hope that any information of similar experiments carried on in our own country may be called forth. The large deposits of titanic ores on the St. Lawrence in Canada, in North Carolina, and especially in northern New York on Lake Champlain, demand an examination of their value. The most extensive known deposits are those in Essex county, N. Y., near the town of Westport on Lake Champlain, and are the mines known at the "Kingdom," "Iron Mountain," and "Split Rock."

The following are analyses of samples of ore selected by myself as the mines and works of the Iron Mountain Company, at Westport.

	Kingdom ore sampled at Westport	Iron Mt. ore sampled at Westport	Kingdom ore sampled at Westport	Iron Mt. ore sampled at the mine	Split Rock ore sampled at the mine
	1	2	3	4	5
Sesquioxide of Iron...	23.77	30.36			38.43
Protoxide of Iron.....	21.24	25.46			23.40
Protoxide of Mangan..	0.87	0.47			0.23
Alumina.....	11.86	9.35			0.34
Lime.....	7.63	7.75			3.54
Magnesia.....		0.13			2.13
Silica.....	21 64	10.26			15.46
Titanic Acid.....	13.15	16.37	12.57	11.50	14.70

Nos. 3 and 4 were examined for titanic acid only.

In the above analyses my assistant, Dr. Wendell, rendered material aid.

The distinguishing characteristics of titanic acid compounds are difficult fusibility and high specific gravity. This has been made evident in all attempts to smelt this character of ore in the blast furnace by the production of exceedingly sluggish slag, and the formation of salamanders in the hearth.

EVIDENCE OF TITANIUM IN THE ASSAY.

In the fire assay of titaniferous ores according to Percy (Iron Met. p. 243.) "the button is smooth on the exterior, breaks under the hammer with dark grey, dull or crystalline fracture. It adheres firmly to the slag, which is often resinous, black, and scoriaceous or curiously wrinkled on the exterior. Externally the slag and sometimes the button is coated with a characteristic copper colored film of *cyano-nitride of titanium*." In my own examination of titaniferous ores, I have frequently found this metallic film to have the bright yellow color of brass.

EVIDENCE IN THE BLAST FURNACE.

The same copper colored metallic deposits are often found in the salamanders of blown out blast furnaces.

TITANIUM IN IRON AND STEEL.

Much has been claimed for the influence of titanium upon iron and steel, and according to PERCY no less than *thirteen* patents were granted ROBERT MUSHET for "alleged improvements in the manufacture of iron and steel and in all the application of titanium plays the chief part." It is not necessary to state in this connection how the various alloys are claimed to be made. PERCY goes on to say that "some analytical chemists of skill and repute declare that they have examined specimens of 'titanic steel' without being able to detect any titanium in it. On inquiry I learn that Mr. MUSHET has not yet succeeded in convincing the Sheffield steelmakers of the surpassing excellence which he claims for his '*titanic steel.*'"

KARSTEN'S RESEARCHES.

"Accordinig to KARSTEN, traces of titanium exist in very many varieties of cast iron; but it is questionable whether in such cases the metal be actually alloyed with or dissolved in the iron, and whether it be not in the state of mechanically diffused cyano-nitride."

ALLOYS OF TITANIUM AND IRON.

"FARADAY and STODART failed in their attempts to introduce titanium into steel. A mixture of steel filings and oxide of titanium, with a little charcoal, was intensely heated, when the steel fused and ran into a fine globule, which was covered with a glass adhering to the sides of the crucible; the steel contained no titanium. The temperature employed was sufficient to soften and almost liquefy the crucible in fifteen minutes."

Mr. RILEY has made the following analyses of pig irons containing titanium:

	1.	2.	3.
Carbon - -	3 31	3.18	3.11
Silicon - -	1.86	3.28	3.55
Sulphur - -	0.071	0.058	0.112
Phosphorus	0.076	0.062	0.093
Titanium -	1.150	0.71	0.470
Manganese -	0.50	0.48	1.09
Iron - - -	93.47	92.79	92.04

No. I. was made with red hematite and 7.5 per cent ilmenite (titaniferous iron ore), of which the following are the analyses:

Magnetic oxide of iron -	46.14	54.72
Titanic acid - - - - -	36.88	40.80
Silica - - - - - - -	13·32	1,58
Magnesia - - - - - -	2.07	2 13
Lime - - - - - - - -	0.78	0.66
Bisulphide of iron - - -	1.05	

This iron was a No. 1 pig, best foundry, found to be practically very strong, and *answered well for the Bessemer process.*

No. 2, not best foundry; No. 3, grey pig. These two samples of pig iron were made with red hematite, mixed with a little Belfast aluminous ore; the effect of the latter on the working of the furnace was stated to be very beneficial.

EFFECT OF TITANIUM ON IRON.

BRUNO KERL states: "When smelting titaniferous iron ores (titaniferous iron sand of New Zealand), or upon adding titanite to the iron ore mixture, grey titaniferous pig iron is produced (not white iron, as in this production most of the titanium enters the slag), which is said to yield an excellent wrought iron and steel; but it is still doubtful whether any portion of the titanium is retained in the wrought iron or steel made from such pig iron, so that the improvement attributed to the use of titaniferous ore is probably due to some indirect action rather than to the actual presence of titanium in the finished product."

LESLEY, in the *Iron Manufacturers' Guide*, says: "Iron and titanium occur together in so many ores that their relations are important."

KARSTEN says that titanium makes the Norwegian iron *strengflüssig*, hard to smelt, so that when the titanium is abundant in the ore the 35-foot charcoal stacks of Arendale cannot smelt it, and it is therefore hand-picked. Otherwise no injury is done the iron, which, in fact, is harder, firmer, and can stand more wear.

HASSENFRATZ experimented with *rutile*, or red short (oxide of titanium), and found his iron remain malleable, and neither red or cold short. It is doubtful if the metals unite chemically.

The following paper, by Mr. DAVID FORBES, in the London *Chemical News* for February, 1869, is the most important contribution to our knowledge of this subject that I have been able to find, "On the Composition and Metallurgy of some Norwegian Titaniferous Iron Ores, by DAVID FORBES:"

"Considerable attention has of late been directed to the utilization of the titaniferous iron ores, which are found abundantly in New Zealand, Canada, Scandinavia, and other countries, under the supposition entertained by many engaged in the manufacture of iron, that these ores yield on smelting an iron or steel alloyed with titanium and of very superior quality.

"In the numerous articles and discussions which have appeared in English journals upon this topic, the subject has been treated as one of entire novelty, and various patents have also been taken out, evidently under the impression that such ores had never previously been utilized, and that their treatment, as well as the nature of their products, had been previously quite unknown to metallurgists. So far, however, from this being in reality the case, it is well known that the titaniferous magnetites of Sweden, Finland and Norway, have from very old periods been mined and smelted on a large scale in the charcoal blast-furnaces of those countries, where their metallurgic treatment and value are thoroughly understood and appreciated; and several Scandinavian ironmasters have expressed to me their surprise at the want of information possessed by English metallurgists in general upon this subject.

My own experience in the smelting of titaniferous iron ores dates from as far back as 1847, when I acted as consultant to some small charcoal iron works in the south of Norway, where such ores were smelted in quantity. From my notes and analyses I have extracted the following remarks:—Titaniferous magnetite (Cristine mine), Krageroe). The color of this ore is brilliant black, and retains its color and lustre even after long exposure to the air and moisture. The following is the result of the analysis:—

Iron - - - - -	42.02 per cent.
Oxygen (as loss) - -	16.03 "
Protoxide of Manganese -	0.14 "
Alumina - - - -	2.61 "
Lime - - - -	2.11 "
Magnesia - - - -	1.88 "
Silica - - - -	19.90 "
Titanic Acid - - -	15.10 "
Sulphur - - - -	0.19 "
Phosphorus - - -	0 00 "
	100.00 per cent.

"Especial attention is called to the fact that there is not a trace of phosphorus in this ore.

"The experience of the Scandinavian ironmasters has shown that the only objection to the use of titaniferous ores is that they are found to be more and more refractory in the blast furnace in proportion as they contain a greater percentage of titanic acid, and if much titanium is present they require so much larger an amount of charcoal to smelt them as not to render their employment profitable in a country where other ores free from titanium can be obtained at reasonable rates."

"After considerable experience in smelting the above ore, which yielded a very good iron, it was found impossible to smelt it alone for the above reason; but its use was found beneficial when employed in about equal proportions with the other ores of the district which were free from titanium. In the attempts to cause it to smelt more easily, my

* A paper read before the American Institute of Mining Engineers, at Philadelphia.

predecessor, under the supposition that a volatile compound of silicon and titanium would be formed, fluxed this ore with gradually increasing charges of stamped quartz until at last a cast iron was obtained so highly charged with silicon that it flowed from the furnace like porridge. I, on the contrary, used lime as a flux, and probably went at first to the other extreme, with the object of slagging off the titanic acid as titanate of lime, but I did not obtain as satisfactory a result. Subsequently, however, the examination of some silico-titanates, which proved much more fusible than pure titanates, led me to employ a mixture of stamped quartz and limestone as a flux, This was found to give very satisfactory results in practice, and when the amount of titanium in the ore did not exceed 8 per cent., or was reduced to this percentage by admixture of other ores of iron free from titanic acid, *no difficulty was experienced in working cleanly and profitably. The cast iron produced, upon analysis, did not contain phosphorus*, only a trace of sulphur, and afforded 0.05 per cent. of titanic acid, equal to 0.03 per cent. of titanium, which, I imagine, was rather mechanically intermixed than chemically combined with the iron. The cast iron possessed a peculiar fracture not easily described, but easily distinguished by the furnace men, who could at once recognize the pig from these ores even after it had been remelted in the cupola. The slags from this ore (and titaniferous ores in general), even in cases where it had only been employed as an admixture of as low as 10 per cent. of the charge, are at once recognizable both by their behavior when fluid as well as their appearance and fracture when cold. As they flow from the furnace a series of blisters (if they may be so called) rise up from the slag sometimes to the height of from six inches to a foot, and of about the thickness of the wrist, after standing up thus for some minutes with a peculiar appearance they suddenly collapse and sink into the still fluid current of slag. The blast furnace, in which these ores were smelted, possessed the following dimensions; Total vertical height from sole of hearth to charging plane 32 feet, height from hearth to tuyeres 1½ feet, ditto to shoulder 6 feet, ditto from shoulder to widest diameter 2 feet, diameter at hearth 2 feet, ditto at shoulder 4 feet, ditto at widest part 7 feet, ditto at charging plane 5 feet. The blast was heated to about 500° Fahr. (260° cent.) by the waste gases from the furnace. The ore was roasted in kilns, situated on the top of the furnace, and heated by the waste gases, and after washing it was broken to the size of nutmegs by rollers. The charcoal employed was a mixture of spruce, fir, and pine, and it required 40 Eng. cubic feet of this charcoal (about 3,744 lbs. in weight) to produce one ton of cast iron. The total yield of cast iron per week from these small furnaces was, on an average, about 16 tons, the ore producing about 33 per cent. of iron.

Titaniferous magnetite (Gullaxsund mine, Eger).

ANALYSIS.

Iron	38.89 per cent.
Oxygen as loss	14.84 "
Protoxide Manganese	0.48 "
Alumina	1.70 "
Lime	3.55 "
Magnesia	3.98 "
Silica	28.10 "
Titanic Acid	7.10 "
Sulphur	0.59 "
Phosphorus	0.77 "
	100.00

"The amounts of phosphorus and sulphur in this ore are so large as to prevent its being employed for the production of charcoal bar iron, as the trials sometimes made for this purpose showed that the bars obtained were extremely red short. The abundance of the ore and its consequent cheapness, as well as its proximity to the smelting works, rendered it however of importance for the production of casting pig. The ore when smelted alone was found to be refractory, and not to produce a liquid slag, but this difficulty disappeared when it was smelted along with other ores free from titanium."

Mr. Henderson, of the late firm of Player & Henderson, makes the following statement:—"Ores are found in Norway and taken to England, having the following composition:—

Sesquioxide of Iron	22.63 per cent.
Protoxide of Iron	28.96 "
Protoxide of Manganese	56 "
Titanic Acid	40.95 "
Alumina	2.11 "
Magnesia	4.72 "
Silica	42 "
	100.35 per cent.

"They are worked in small furnaces with 1,000° temperature of blast at Norton on a plan patented by John Player. The charge is 2 tons to 2½ tons of ore, 15 cwt. of limestone, and about 10 cwt. of basalt. The iron becomes titanized, and is found to be exceedingly strong, and is used in Europe for armour plates, commanding three times the price of ordinary pig iron. The tensile strength of the resulting wrought iron when puddled is about 52½ tons to the square inch. There is very little carbon in the pig metal, and being almost steel, in puddling it requires but half the time of ordinary pig."

I find in the *Berg und Hüttenmännische Zeitung* for 1866, p. 396, the following:—

"An extensive Titanic iron (Ilmenite=Titanium, 36-44 per cent.) at Sogndal and Egersund, Norway, is being worked by an English company. Of this ore 5 per cent. is added in the blast furnace working, the result being a most admirable grey iron for steel purposes. In 1864, 2,500 tons were shipped to England."

The following is also from the same journal for 1868:

"Mr. George Crawshay, of the firm of Hawk, Crawshay & Sons, at Gateshead-on-Tyne, and John Thomas of Newcastle-on-Tyne, have patented the following mode of procedure in the treatment of titaniferous iron ores. By washing the ores and suddenly cooling them in cold water, the lumps are rendered friable, and the titanic acid is in part converted into titanic oxide. The charge consists ordinarily of 1 ton titanic ore, 1 ton pig iron, 3 cwt. raw or burnt clay, 4 cwt. limestone, 15 cwt. fuel. Charcoal is found to give the best results. The amount of pig iron is dependent upon the percentage of titanic acid in the ore."

Of all the plans suggested for the treatment of this class of ores, the one just mentioned is the most absurd.

A leading article in "Engineering" for April 1st, 1870, speaks in the highest terms of Mushet's "*special steel*," manufactured by the "Titanic Steel and Iron Co." of Coleford. For tool steel it is claimed to be superior to any other known steel. The peculiarity of the steel is that it does not require hardening in the ordinary way, but only needs a light cold hammering. The firm of Messrs. John Fowler & Co. of the Steam Plow Works, Leeds, use extensively tools made from this steel.

In October, 1870, it was announced that the works at Coleford were being very much enlarged for the production of titanic steel.

I cannot find any account of the methods employed.

I believe I have given the principal evidence for and against the use of titaniferous ores. That titanium has a beneficial influence upon iron and steel there seems to be no question, but why this additional element of strength is communicated is not yet fully determined. In a subsequent paper, I purpose giving the theories that have been advanced. The information which I have collected sets at rest the question of the employment of ores containing any considerable percentage of titanium *alone* in the blast furnace, or even to any considerable extent. That they may be used in conjunction with purer and more fusible ores with benefit to the iron produced seems to be certain, but sooner or later infusible salamanders will be formed in the hearth.

Menalaus of the Dowlais Works in his experiments with his mechanical puddling furnace found that titaniferous ore was the only ore which would stand as a fettling.

All experiments which have been made with titaniferous ores in the forge fires of Lake Champlain have proven unsuccessful.

For accounts of the treatment of titaniferous iron sands, I refer to Dr. T. Sterry Hunt's article in the last report of the Canada Geological Survey, and late communications in the ENGINEERING and MINING JOURNAL.

The Stassfurth Manufactures.

IN the ENGINEERING AND MINING JOURNAL for January 30, 1872, we reported a paper read before the Polytechnic Association by Dr. FEUCHTWANGER, on the saline deposits of Stassfurth, in Prussia, and took exception, in an appended editorial note, to some of its statements. One of our remarks was, that the production of chloride of potassium at the Stassfurth works is 30,000 tons annually, not 30,000 in all since the commencement of the business, ten years ago, as Dr. FEUCHTWANGER said in his paper. He however furnished us with the following estimate, from the *Chemisches Centralblatt* of March 20, which we are glad to publish, as of general interest, though we do not think it disproves our assertion.

The estimate is for the productive power of the Stassfurth Chemical Works of VORSTER and GRÜNEBERG; according to this authority the existing arrangements of the two establishments allow the production of 4,750 tons of chloride of potassium, 2,000 tons of sulphate of potash, 1,000 tons of potash, 300 tons of soda, 10,000 tons of manure salts (kieserite, hydrated sulphate of magnesia), chloride of magnesium, etc., 2,000 tons of hydrochloric acid and 1,250 tons of superphosphates, the whole valued at 858,000 thalers, or about $620,000.

To this we have to remark, first, that the *annual* product of chloride of potassium from the Stassfurth deposits is distinctly stated by Dr. J. LAWRENCE SMITH (U. S. Paris Exposition Reports, vol, II; Report on Industrial Chemistry, page 40) at 20,000 to 30,000 tons. Secondly, Dr. FEUCHTWANGER himself says in his paper that 3,000 tons were brought last year to the United States. This would be more than half the whole product, if the above estimate included the whole product. Thirdly, and conclusively, the estimate in the *Centralblatt* refers to two establishments alone; but in 1866 there were already *thirteen* in that district, all manufacturing chloride of potassium. It is quite likely that some of these have suspended operations, as the over-production of this article caused a considerable fall in price, but it is not likely that the total product for ten years was only 30,000 tons, as given by Dr. FEUCHTWANGER. Unfortunately the official returns of annual production as published in the *Berg-und Hüttenmännische Zeitung*, include rock-salt and the soda and potash salts in one item, so that we cannot at this moment give the exact figures. But we find in STOHMANN and KERL's edition of MUSPRATT, (vol. III, p. 483) that the mines delivered to the works in 1864 alone 125,000 tons of carnallite, containing 17 per cent., or 21,250 tons of chloride of potassium. Hence we are inclined to think that Dr. SMITH is right and that Dr. FEUCHTWANGER is in error; though we should perhaps not undertake to "decide, when doctors disagree."

THE amount of coal now shipped from Pittsburgh is enormous. According to the *Iron World and Manufacturer*, there were shipped in one week from that port seven millions five hundred and three thousand bushels of coal, mostly destined for Cincinnati. It was conveyed by sixty-seven tow boats in six hundred and forty-five barges and is worth, at fifteen cents per bushel, over one and a quarter millions of dollars.

THE COAL TRADE.

NEW YORK, April 26, 1872.

Anthracite Coals.

The state of the coal market remains almost unchanged. The Scranton sale on Wednesday excited some unwonted life in the trade and the reaction leaves affairs dull.

As advertised, one hundred and thirty thousand tons of coal were disposed of as follows, according to the official record of the sale.

DELAWARE, LACKAWANNA & WESTERN R. R. CO.

General Office, 26 Exchange Place, New York.

One hundred and first auction sale, April 24th, 1872; 130,000 tons.

6000 tons	Lump..	$3 47½	to	Average..	$3 47½
12000 tons	Steamer	3 45	to 3 47½	"	3 46¼
22000 tons	Grate..	3 45	to 3 50	"	3 45½
20000 tons	Egg....	3 45	to 3 47½	"	3 45½
50000 tons	Stove...	3 85	to 4 00	"	3 89
20000 "	Chestnut	3 37½	to 3 40	"	3 38

The prices of the Pennsylvania Coal Company for their Pittston coal have been somewhat advanced. We quote them as follows:

Lump	$3 90
Grate	4 00
Egg	4 10
Stove	4 25
Chestnut	4 00
Steamer	3 90

The prices fixed for Lehigh Coal by the Exchange, are unchanged. Freights vary but little from the quotations given last week. Some alterations will, however, be found in our table.

Anthracite Coal Trade for 1871 and 1872.

The following table exhibits the quantity of Anthracite Coal passing over the following routes of transportation for the week ending April 20, 1872, compared with the week ending April 22, 1871.

COMPANIES.	1871. WEEK.	1871. TOTAL.	1872. WEEK.	1872. TOTAL.
*Phila & Reading R.R†	39,706	849,805	128,740	1,406 851
Schuylkill Canal	7,708	56,256	33,988	99 159
*Lehigh Valley R. R.	12,460	431,490	63,609	1,086,499
Lehigh & Sus. R. R.	15,344	118,698	39,892	436,459
Lehigh Canal	1,091	1,943	21,319	29,868
Scranton North	....	3,521	10 190	181,847
" South	....	137	47,359	624,223
Penn. Coal Co., rail	....	3,565	31,825	313,089
" " " canal	....	.....	....	.....
Del. & Hud. Canal Co.	2,160	4,661	5,892	16,589
" " East	633	52,144	14,398	190,739
" " West	....	12,720	.. ..	104,283
" " South	....	.....	8,289	104,832
Shamokin	23,345	165,364	7,450	126,926
Trevorton	..	.....	....	....
Lykens Valley Coal Co.	2,016	18,715	..	2,580
Wyoming South	....	.....	....	....
Wyoming North	....	.....	....	....
P. N. Y. C. & R. R. Co.	41	35,343	10,414	198,699
Williamstown Co'y	....	17 847	....	....
Big Lick Col	3,146	29,122	....	10,591
Total	104,690	1,801,321	423,395	4,933,225
1870	....	....	404,690	1,801,321
Decrease				
Increase			318,695	3,131,904

* These figures are for the week and fiscal period commencing Nov. 30

† Less coal transported for Co's use and Bituminous coal.

Bituminous Coal Trade, 1871 and 1872.

The following table exhibits the quantity of Bituminous Coal passing over the following routes of Transportation for the week ending April 20, 1872, compared with week ending April 22, 1871.

COMPANIES.	1871. Week.	1871. Year.	1872. Week.	1872. Year.
C. & O. Canal	19,029	107,248	18,677	82,767
B. & O. R. R.	30 863	313,136	28,284	325,954
H. & B. T. R. R.	....	91,198		87,940
*Harrisburg & D.	15,778	162,321	6,956	183,992
*L. V. R. R.	10,591	23,325	404	11,195
P. & N.Y.C. & R. Co.	5,585	87,221	8,338	119,217
Cumberl'd Branch Canal	5,569	31,258	6,530	26,849
" Railroad	1,356	22,440	814	2,041
Total	88,771	840,147	70,003	839,855
	70,003	839,855		
Decrease	18,768	292		
Increase				

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, April 20, 1872.

	WEEK.	SEASON.
North	43,730 01	727,353 14
South	8,288 19	104,831 18
Total 1872	52,019 00	832,185 13
Corresponding time in 1871:		
North	Suspension.	
South	"	
Total		
Increase North		
Decrease North		
Increase South		
Decrease South		
Total decrease 1872		
Total increase 1872	52,019 00	832,185 13

Philadelphia & Reading Railroad and Branches.

COAL TONNAGE

For the Week ending Saturday, April 20, 1872.

BY RAILROAD.—ANTHRACITE.

PASSING OVER MAIN LINE AND LEB. VAL. BRANCH.

	Tons.	Cwt.
From St. Clair	19 549	10
" Port Carbon	5,071	11
" Pottsville	2,825	09
" Schuylkill Haven	27,588	08
" Pine Grove	5,856	03
" Tamaqua	16,664	14
" Harrisburg		
" Dauphin	6,411	07
Total	83,967	02

FOR SHIPMENT BY CANAL.

Passing Frackville Scales	7,023	07
" Mill Creek "	3,916	06
" Schuylkill Valley Scales	1,373	15
" Mt. Carbon "	856	17
" Cressona "	17,882	14
" Pine Grove "		
" Tamaqua "	2,092	06
Total	33,145	05

SHIPPED WESTWARD VIA NORTHERN CENTRAL RAILROAD.

Passing Locust Gap	1,453	05
" Shamokin	3,019	17
" Herndon	.....	
Total	4,473	02

SHIPPED WEST OR SOUTH FROM PINE GROVE.

Via Schuylkill & Susquehanna R. R.	1,324	00
" Lebanon & Pine Grove Branch	896	18
Total	2,220	18

CONSUMED ON LATERALS.

From Frackville Scales	374	09
" Mill Creek "	465	15
" Schuylkill Valley Scales	627	16
" Mt. Carbon "	549	00
" Cressona "	262	12
" Pine Grove "	239	16
" Tamaqua "	967	07
Total	3,486	15

LEHIGH AND WYOMING COAL.

Received via Allentown, E. Penn'a Br.	85	08
" " Alburtis, " "		
" " Oreland, G. & N. Br.	888	03
" " Connecting R. R.	.....	
" " Willow Street R. R.	473	03
Tota	1,446	14

BITUMINOUS.

From Harrisburg	6,925	13
" Connecting R. R., G. & N. Br.		
" Junction R. R.	30	02
Total	6,955	15

COAL FOR COMPANY'S USE.

Anthracite	4,741	05
Bituminous	182	08
Total	6,119	13

RECAPITULATION

	Total for Week.	Corres-p'g week last year.	Increase and Decrease.
Passing over Main Line and Leh. Val. Branch	83,967 02	15,771 11	i 68,195 11
For Shipment by Canal	33,145 05	8,294 04	i 24,851 01
Shipped Westward via Northern Central R. R.	4,473 02	12,888 00	d 8,414 18
Shipped West or South from Pine Grove	2,220 18	1,124 02	i 1,096 16
Consumed on Laterals	3,486 15	1,666 13	i 1,820 02
Lehigh and Wyoming Coal	1,446 15	31 08	i 1,415 06
Total Anthracite paying freig't	128,739 16	39,775 18	i 88,963 18
Bituminous	6,955 15	15,778 05	d 8,822 10
Total of all kinds paying freig't	135,695 11	55,554 03	i 80,141 08
Coal for Company's use	4,923 13	5,350 06	d 426 13
Total Tonnage for Week	140,619 04	60,904 09	i 79,714 15
Previously this year	1543695 19	1031525 17	i 512,170 02
Total to date	1684315 03	1092430 06	i 591,884 17
SHIPPED BY CANAL.			
From Schuylkill Haven	31,651 03	5,237 10	i 26,413 10
" Port Clinton	2,337 00	4,109 00	d 1,772 00
Total Tonnage per Week	33,988 03	9,346 10	i 24,641 10
Previously this year	65,171 09	51,302 02	i 13,869 07
Total to date	99,159 09	60,648 12	d 38510 17

Report of Coal Transported over Central R.R. of N. J. (Lehigh and Susq. Div.)

Week ending April 20—Compared with same time last year.

WHERE SHIPPED FROM	WEEK 1872., tons ct	WEEK 1871., tons ct.	YEAR 1872 tons cwt.	YEAR 1871, ons.cwt.
Wyoming Region	33518 13	17996 11	326289 04	112203 01
Upper Lehigh Region	5002 09		59167 17	4614 06
Beaver Meadow Region				
Hazleton Region	7328 13	6 01	13232 07	1126 18
Mahanoy Region				
Tresckow Region	3864 16		23930 13	1043 03
Mauch Chunk Region	8277 16	698 12	115987 02	20354 04
Totals	57992 07	18701 04	538607 03	139341 12
Increase	39291 03		399265 11	
Decrease				
DISTRIBUTION.				
Forwarded East of Mch Chunk by Rail	39881 17	15344 02	436458 14	118698 06
Forwarded East of Mch Chunk by Canal	13697 12	1165 18	18556 18	1769 00
Delivered at and above Mauch Chunk	1290 00	2106 15	19750 19	16659 18
L. V. R. R at Packer'n	410 06	84 09	4867 02	2824 08
Delivered to L. & B. R. R. at Plymouth Bridge	2682 11		58973 10	
Totals				
Of the above there was transported on acc'nt of L. C. & N. Co.	12437 11	698 12	129379 07	21590 11
W.-B. C. & I. Co.	26159 11	16144 02	240131 08	9327 04
Totals	38597 02	16842 14	369510 13	111918 00
Increase	21754 04		257592 13	
Decrease				

Report of Coal Transported over Lehigh Valley Railroad

Report of coal tonnage for the week ending April 20, 1872, with totals to date, compared with same time last year.

WHERE SHIPPED FROM.	WEEK. Tons.	WEEK. Cwt.	TOTAL Tons.	TOTAL Cwt.
Total Wyoming	8,337	10	185,970	00
" Hazleton	47,961	8	721,564	01
" Upper Lehigh	62	03	1,136	07
" Beaver Meadow	16,190	19	260,626	11
" Mahanoy	10,210	00	98,351	13
" Mauch Chunk	69	08	1,373	05
Total	82,831	18	1,269,225	17
Same time last year	13,264	09	488,961	14
Increase	69,567	09	780,244	03
Decrease				
Forwarded East from Mauch Chunk by rail	63,698	16	1,088,785	08
Same time last year	12,460	09	430,489	17
Increase	51,148	07	655,295	11
Decrease				

DISTRIBUTED AS FOLLOWS.

Forwarded East from Mauch Chunk by rail	62,654	18	1,006,465	03
do East for use L. V. R. R.	953	18	20,320	05
Delivered at and above Mauch Chunk for use of L. V. R. R.	1,321	12	22,982	11
To P. & N. Y. R. R.	5,405	00	113,041	12
To N. C. R. R., at Mount Carmel			73	06
To D. H. & W. R. R.	831	13	9,544	03
To L. & S. R. R. at Packerton for rail	91	17	5,831	18
Delivered at M'h Chunk	45	17	838	02
Delivered on line of road above Mauch Chunk	290	02	8,595	16
To L. & S. R. R., at Penn Hav., for railroad			3,959	07
Do. for canal	6,966	06	9,072	13
To Lehigh Canal Mauch Chunk	4,092	17	6,138	04
To Catawissa Railroad	179	18	2,372	06
Total	82,831	18	1,269,225	17

Penn. and N. Y. R. R.—Coxton, Pa.

Coal tonnage for week ending April 20, 1872.

	Week. Tons.	Cwt.	Total. Tons.	Cwt.
Anthracite received:				
From Lehigh Valley R. R.	5,403	00	113,041	12
" Lack. & B. R. R.	1,693	18	28,398	08
" Pleasant Valley R. R.	1,983	16	36,617	16
" Sul. & Erie R. R.	1,362	18	20,701	11
Total	10,443	12	198,699	06
Distributed:				
To Lehigh Valley R. R.	1,283	13	19,783	11
To Lack. & B. R. R.			1,017	17
To S. Central R. R	2,434	04	36,007	07
To Ithaca & A. R. R.	644	13	44,584	16
To Erie R. W. Pockets for shipm't.	5,325	12	69,264	11
To individuals on line of road	189	18	11,440	07
To points at & above Coxton for use of Co	382	06	9,724	07
To points between Waverley and Elmira	186	06	16,876	10
Total	10,443	12	198,699	06
Bituminous:				
Received from Barclay R. R.				
Shipped North from Towanda	8,282	15	118,205	03
Shipped South from Towanda	55	00	920	12
Northern Central R. R.			91	01
Total	8,337	15	119,216	16
Distributed:				
To Erie R. R.	7,465	14	104,436	15
To So. Central R. R.	817	01	13,616	13
To Ithaca & A. R. R.	.....		21	15
To Lehigh Valley R. R.	55	00	790	02
To individuals on line of R R	.....		263	11
To points on line of road for use of Company			88	09
Total	8 337	15	119,216	16

Delaware and Hudson Canal Company.

The following is a statement of Coal Transported by the Delaware and Hudson Canal Co. for the week ending April 22, 1872.

	FOR THE WEEK.	FOR THE SEASON.
By Delaware and Hudson Canal,	5,892	16,589
By Railroad, East	14,398	190,739
" " West		104,283
" " South	8,289	104,832
Total Tons	28,579	416,443

For the same period last year.

	FOR THE WEEK	FOR THE SEASON.
By Delaware and Hudson Canal,	2,160	4,660
By Railroad, East,	633	52,144
" " West	.....	12,720
" " South	.....	.....
Total Tons	2,739	69,524
Increase	346,919	

Shamokin Coal Trade.

For week ending April 20, 1872	7,450 10
Same time last year	20,344 15
Increase	
Decrease	12,894 05
Total amount shipped to date	126,925 18
Same time last year	165,364 09
Increase	
Decrease	38,438 11

Pennsylvania Coal Company.

Shipments of Pittston Coal for the week ending April 20, 1872.

	1872. WEEK.	1872. YEAR.	1871. WEEK.	1871. YEAR.
By Railway	31,825 10	313,089 02		
" Canal				3,566 08
Total	31,825 10	313,089 02		3,566 08
Increase 1872		309,522 14		

Lehigh Canal Coal Trade.

Shipped for the week ending April 19th, 1872.

		Week. Tons.	Cwt.	Week. Tons.	Cwt
Total from Mauch Chunk Region		8,260	05	12,781	11
" " Beaver Meadow	"	3,784	02	5,632	17
" " Treskow	"	969	04	1,345	00
" " Mahanoy	"	286	08	483	13
" " Hazleton	"	7,165	02	8,407	02
" " Upper Lehigh	"	669	10	946	14
" " Wyoming	"	84	05	271	05
Total		21,318	16	29,868	02
Corresponding week last year		1,060	17	1,942	15
Increase		20,257	19	27,925	07
Decrease					

Schuylkill Canal.

Report of coal transported over the Schuylkill Canal for the week ending Saturday, April 20, 1872.

	Tons.	Cwt.
From Schuylkill Haven	31,651	00
" Port Clinton	2,337	00
Total for week	33,988	00
Previously this year	65,171	09
Total	99,159	09
To same time last year	56,256	02

Statement of Coal Transported over Cumberland and Pennsylvania Railroad

During the week ending Saturday April 20, and during the year 1872, compared with the corresponding period of 1871.

WEEK.

	To C. & O. Canal Tons.	Cwt.	To B. & O. R.R. C. Tons.	Cwt	Total. Tons	Cwt.
1872	18,676	19	28,284	07	46,961	06
1871	19,029	05	30,863	13	49,892	18
Increase						
Decrease	352	06	2,579	06	2,931	12

YEAR.

1872	82,767	10	325,954	11	408,722	01
1871	107,247	12	313,135	18	420,383	10
Increase			13,818	13		
Decrease	24,480	02			11,661	09

Cumberland Branch R. R.

WEEK.

	To C. & O. Canal. Tons.	Cwt.	To B.&O.R.R. Co Tons	Cwt.	Total. Tons.	Cwt.
1872	6,530	08	814	02	7,344	10
1871	5,568	19	1,355	19	6,924	18
Increase	961	09			419	12
Decrease			541	17		

YEAR.

1872	26,848	14	2,040	12	28,889	06
1871	32,257	11	22,440	09	55,698	00
Increase						
Decrease	6,408	17	20,399	17	26,808	14

Huntington and Broad Top R. R. Co.

For week ending April 13, 1872	4,450	tons.
Same time last year	9,060	"
Increase		
Decrease	4,610	"
Total amount shipped to date	87,940	"
Same time last year	91,198	"
Increase		
Decrease	3,258	,,

Lehigh Coal and Navigation Company,

Report of Coal transported over the Lehigh Canal and L. & S., Div. of Central Railroad of New Jersey for the week ending April 13, 1872, and for the year 1872.

	WEEK.	YEAR.
Forwarded East of Mauch Chunk by Rail	20 753	396,576
Delivered at and above do.,	1,196	18,467
Forwarded East of do., by Canal	8,549	8,549
	30,499	423,587
Corresponding period last year—		
Forwarded East of Mauch Chunk by Rail	13,609	103,344
Delivered at and above do.,	1,957	14,553
Forwarded East of do., by Canal	163	881
	15,729	118,779
Increase on Railroad	6,383	297,140
Decrease " "		
Increase on Canal	8,383	7,667
Decrease " "		
Of the above there was transported on account of—		
Lehigh Coal Nav. Co	12,921	121,463
Wilkesbarre Coal & Iron Co	7,231	213,971
	20,153	335,434
Correaponding period last year—		
Lehigh Coal Nav. Co	652	20,986
Wilkesbarre Coal & Iron Co.	13,700	74,183
	14 352	95,170
Increase	5,800	240,264
Decrease		

Delaware Lackawanna & Western Rail Road Company.

Coal transported on the Delaware. Lackawanna and Western R. R., for week ending April 26, 1872:

	Week. Tons.	Cwt.	Year. Tons.	Cwt.
Shipped North	10,190	11	181,847	08
Shipped South	47,358	17	624,223	02
Total	57,549	08	806,070	11
For the corresponding time last year:				
Shipped North				
Shipped South				
Total	7,759	03	13,019	05
Increase	49,790	05	793,051	06
Decrease				

Prices of Coal by the Cargo,

[CORRECTED WEEKLY.]

SCHUYLKILL.	AT NEW YORK, April 26. R. A.	W. A.	AT PHILADELPHIA. April 26. R. A.	W. A.
Lump	$—	$—	—	—
Steamer	—	—	—	—
Broken	—	—	—	—
Egg	5 25	4 75	—	—
Stove	5 50	5 00	—	—
Chestnut	4 25	—	—	—
Pea	—	—	—	—
LEHIGH.				
Lump, (along side)	5 00	—	—	—
Broken	4 75	—	—	—
Egg	4 50	—	—	—
Stove	5 25	—	—	—
Chestnut	4 25	—	—	—
Pea	—	—	—	—
SPECIAL COALS.*				
Honey Brook, Le'h W.A.	4 00@4 75		—	—
Spring Mountain " "	—@—		—	—
Sugar Creek " "	—@—		—	—
Sugar Loaf " "	—@—		—	—
Old Comp'y's " "	4 00@4 75		—	—
Room Run " "	4 00@4 75		—	—
McNeal " "		—	—	—
Girardville " "		—	—	—
Hill & Harris " "		—	3 10@4 00	—
Shamokin " "		—	—	—
Lykens Valley " "		—	—	—
Broad Top " "		—	—	—
McMichael " "		—	3 25@4 25	—
Henry Clay " "		—	—	—
Powelton "		—	—	—

Dealers in these coals may be found in our advertising columns.

Company Coals.

April, 1872.

	L.	Str.	Gra	Eg.	Sto	Chest
*Scranton at E. Port	3 47	3 53	3 60	3 63	4 19	3 58
*Pittston at Newburg	3 90	3 90	4 00	4 10	4 25	4 00
*Lackawana at Weehawken	3 75	3 75	3 85	3 85	4 25	3 75
Wilk'b're at Hoboken	3 75	3 75	3 85	3 85	4 25	3 80
Old Co. Lehigh at PtJohn'n	5 25	—	4 40	4 40	4 60	4 10
Lehigh at Eliz. Port	5 00	—	4 25	4 25	4 50	4 00

For freights to different points see "Freights."

* To contractors only.

Bituminous Coals (Cumberland).

Georgetown, F.o.b.	$4.25
Baltimore "	4.70
New York "	6.75

Prices of Gas Coals.

April, 1872.

PROVINCIAL.

Corrected weekly by Louis J. Belloni, Jr., 41-43 Pine st., N. Y

	Duty, $1 25, gold Coarse.	Slack.
Block House	$1 60 @-1 75	
Gowrie	1 60 @-1 75	

Corrected by Bird, Perkins & Job, 86 South street.

	Coarse.	Culm of Coal.
Pictou	$2 25	@1 25
Sydney	25	@- 80
Lingan	1 60	@- 80
Little Glace Bay	1 60	@1 00
Caledonia	1 60	@- 80

A discount from the prices of the coarse Coal on purchase of 5000 tons and upwards. Duty $1 25 per ton, gold, on the coarse coal, 45 per cent. ad valorem on the Culm of Coal

AMERICAN.

	Currency.
Westmoreland	$7 00 @- —
Fairmount Gas Coal Co. of N. Y.	7 00 @- —
Despard Coal Co.	7 00 @- —
Penn	7 00 @- —
Newburg Orrel Gas	- — @- —
West Fairmount Gas Coal	7 00 @- —

AT PHILADELPHIA.

Powelton	$6 75

TO NEW YORK.

Provincial	
Sidney	$3 25
Lingan	3 25
Cow Bay	3 12½
Port Caledonia	3 37½
Little Glace Bay	3 25

Prices of Foreign Coals.

April, 1872.

Duty $1 25 per ton.

Corrected weekly by PARMELE BROS., No 32 Pine street, N. Y.

Liverpool Gas Caking	$ 8 00@— —
" " Cannel	12 00@13 00
" House "	18 00@20 00
" Orrel	14 00@16 00

Per ton 2,240 lbs., ex-ship.

PRICES FROM YARD.

Liverpool House Orrel, screened	$16 00@17 50
"Cannel, "	20 00@25 00

Per ton 2,000 lbs. delivered.

Rates of Transportation to Tide Water.

BY RAILROAD.

TO PORT RICHMOND, PHILADELPHIA.

Philadelphia and Reading Railroad, from Schuylkill Haven for consumption	$1 85
For reshipment	1 75

MAUCH CHUNK TO ELIZABETHPORT.

L. V. Railroad from Mauch Chunk to Phillipsburgh	$0 66
C. R. R., N. J., Phillipsburgh to Elizabethport	0 98
Shipping expenses at Elizabethport	25
Wharfage	10
Total	$1 99

MAUCH CHUNK TO PORT JOHNSON.

L. V. R.R., or L. & S. R.R. from M. C. to Phillipsb'g	$0 66
C. R. R., of N. J., Phillipsburgh to Pt. Johnson	0 98
Shipping expenses	25
Wharfage	10
Total	$1 99

TO HOBOKEN.

L. V. R. R., Mauch Chunk to Phillipsburgh	66
Morris & Essex R. R. Phillipsburgh to Hoboken	0 98
Shipping expenses	25
Wharfage	10
Total	$1 99

TO SOUTH AMBOY.

L. V. R. R.	66
L. & D. R. R. or Cam. & Am. R. R.	83
Shipping Expenses	35
Total	$1 84

PENN HAVEN TO ELIZABETHPORT.

L. V. R R. Penn Haven to Phillipsburgh	0 78
C. RR. of N. J. Phillipsburgh to Elizabethport	0 98
Shipping expenses	25
Wharfage	10
Total	$ 1 12

Freights.—April, 1872.

TO EASTERN PORTS.	Cumberland. From Georgetown.	From Baltimore.	Anthracite. From Philad'a.	From Elizabeth Port, Port Johnson, and Hoboken.	From Newbury	From Rondout
Amesbury				2 95		
Bangor				2 80		
Bath						
Boston	3 25	3 75	3 75	2 60		2 90
Bridgeport	2 75	2 75		1 00		1 25
Bristol				1 70		1 85
Derby	3 58			1 25		
Dighton	3 00	2 75				
East Cambridge						1 85
Fall River	3 00	3 00		1 60		
Hackensack						
Hartford	3 50			1 50		1 75
Hoboken	2 10					
Jersey City	2 10	2 00		50		
Middletown						1 50
Mystic				1 35		
New Bedford	3 0	3 00		1 70		1 85
Newburyport		3 50		2 75		3 10
New Haven	2 75	2 75		1 00		
New London	3 00	2 75		1 30		1 25
Newport				1 70		1 80
New York	2 15	2 15		50		65
Norwalk				1 00		1 25
Norwich				1 40		1 60
Pawtucket				2 80		1 95
Portland		3 75		2 45		3 10
Portsmouth, N. H		3 90		2 80		
Providence	3 00	3 00		1 75		1 85
Rockport						
Saco						
Sag Harbor		3 75				
Salem		3 85		2 50		2 90
Stamford						
Stonington				1 20		1 65
Taunton						
Warren				1 70		
Washington						
TO RIVER PORTS.						
Albany					55	
Catskill					50	
Cocksackie					40	
Coeyman's					65	
Cold Spring					20	
Fishkill					20	
Haverstraw					40	
Hudson					40	
New York						
Nyack					45	
Poughkeepsie					30	
Rhinebeck					30	
Rondout						
Saugerties					40	
Sing Sing					50	
Stuyvesant						
Tarrytown					50	
Troy					75	
West Point					20	
Yonkers					50	

MARKET REVIEW.

FOR THE WEEK ENDING APRIL 25, 1872.

IRON—Scotch Pig is for the moment in very small supply, but the demand is equally light, and the pause in the inquiry has caused a nominal condition of the market, and it is difficult to give quotations, especially as considerable receipts are known to be near at hand. We have no sales to report, but quote Glengarnock offered to arrive at $49, and Eglinton and Glengarnock on the spot $54a$55. American Pig is almost as inactive as Scotch, and prices may be said to have a downward tendency, as the late extreme advance is not sustained. Holders of parcels now coming on the market from purchases early in the season are disposed to sell, but do not find buyers to any considerable extent, consumers finding the raw material higher in proportion than those of their manufactures, hence we have cautious buying, a dull market, and rather declining prices. We notice sales of 50 tons No. 1 at $50; 250 do. No. 1 ex Lehigh, $51, at Hoboken; and 150 do. Crane, on terms not made public. We quote No. 1 $50a$51, No. 2 $49a$50, Forge $47a$48, and at the furnace $46. Scrap is very scarce, late sales having swept the market of all available lots. Consumers are fairly supplied, but there is still a good demand, though at prices below the extreme views of holders; sales 550 tons old Wrought, here and to arrive, 500 do. to be shipped from Europe to an Eastern port, on terms we did not learn; and 450 do. from yard, part $65. New Rails are wanted, but scarce for immediate delivery, and very firm; 1000 tons English sold on terms we did not learn; we quote English $73a$75 gold, and American $85 currency at mill, at which 3000 tons of the latter, 56 lb., have been disposed of. Old Rails are in good demand; we notice 500 tons T at $53 gold, delivered here; and 500 do. Double-headed, besides considerable sales same for future delivery, on terms not transpired. Refined Bar continues very firm, but there has been no further change made in prices—all the primary markets continue very strong, and, if anything, a little ahead of the distributing channels. Sheet continues very firm—1000 bdls. B. B. Galvanized Sheet sold at 10 per cent. discount.

PHILADELPHIA, April 22.—(From Circular of EDWARD SAMUEL.)—In the Western market Neutral grades of Pig Iron are quiet, the demand being more for "Red Shorts." Old Rails are not so firm; we note a sale of 3000 tons D. H. to arrive here at $55 gold. Bar Iron is active under

the advance, East and West, and the mills are full of orders. Closing prices American No. 1 Foundry Pig at furnace $49a$50, No. 2 $48a$49, No. 3 Forge $46a$47, No. 4 White and Mottled $41a$43, American Refined Bar (mill price) $103,04 or 4.6 cents, and Rails (at mill) $82a$85.

LONDON, April 11.—The following is condensed from the circular of S. W. HOPKINS & Co:—

EXPORT OF RAILS FROM GREAT BRITAIN.

	1871.	1872.
3 months ending 31st March, 1870.		
To United States.....tons.	80,789	102,965	129,605
All other countries.....	128,362	71,514	71,716
Total.....tons.	209,151	174,479	201,321
Old Iron to all countries.....	23,458	21,770	18,828
Pig Iron to United States.....	21,665	35,369	32,337

We append the following remarks from RYLANDS' Iron Trade Circular of the date of the 14th inst.

We have to record this week another advance in the price of finished iron, and, as that advance was expected, its effect will not be so very serious. As to the legitimacy of this advance there cannot be much doubt, for, setting aside the continued rise in the price of pig iron and the insufficient supply of fuel and ironstone to the works, the enormous demand which is now upon us will alone account for the increase in the selling price of the finished article. Still, we feel persuaded that had the mills and forges been well supplied with fuel and pig iron, the out-put of manufactured iron would have been much greater and the demand would have been better met, and, as a consequence, the price would hardly have got so far as the present very high figure. This restriction in the make is of serious consequence to ironmasters. With their plant and works in perfect order, filled with a satisfied and willing staff of workmen, who are and would be reaping the full benefit of the present range of price, the masters are not getting that advantage they are so justly entitled to receive, and the demand is crippled at a time when the fullest liberty should obtain.

COPPER—Manufacturers have not reduced their prices, and we quote as before, New Sheathing, over 12 oz., 46 cents, Bolts and Braziers 48, Bronze and Yellow Metal Sheathing 30, and Y. M. Bolts 32, net cash. The pause in Ingot continues, and, for parcels on the spot, prices are irregular and lower; for future delivery the market is firm; the sales embrace about 250,000 lb. Lake at 42a43 cents for cash lots, and 35½ for forward delivery. English is held at 35a35½ cents currency.

LEAD—Pig is quiet but firm; ordinary Spanish may be quoted 6¾a6½ cents, and Refined Foreign 6¾a7, gold. Bar 8½ cents, Sheet and Pipe 10, and Tin-lined Pipe 15, usual discount to the Trade.

STEEL—Contrary to all expectation, entertained at an earlier date, prices have undergone little or no change for either foreign or domestic, for many months—an advance in foreign would favor the domestic article, and the latter cannot advance, independent of the former.

SPELTER—There is but little Foreign here outside of Dealers' hands; 10 tons Silesian sold at 7¼ cents gold; and 50 do., to arrive, on private terms. Parcels to arrive are held at 7¼ cents for common up to 7½ gold for prime brands. Domestic 10 cents, currency.

TIN—Buyers of Pig do not respond to the recent considerable advance consequent upon the result of the Dutch sale, and, with but a limited demand, the turn of the market is adverse to sellers; we have only to notice the sale of 200 slabs Straits at 41½ cents. There is however no pressure to realize, and 42 cents is still generally demanded for Straits, 41¾a42 for English, and 50 for Banca, all gold. Plates continue in request, and prices remain quite firm. Sales have been made of 1090 bxs. Assorted Charcoal Tin at $13,37½a$13,50 for I. C.; 1000 do., to arrive, $13,50; 150 do. extra, $13,37½; 100 do. Charcoal Terne, $12,37½, 500 do. Coke Tin, 10 by 14, to arrive, $12,25; 200 do. 14 by 20, $12,25; 350 do. medium Coke Terne, $11,12½, all gold; 1000 do. Charcoal Tin, 1500 do. Charcoal Terne, and 500 do. Coke Tin, on private terms.

ZINC—Mosselmann Sheet continues steady, though rather quiet at previous prices—small lots from store sold at 9¼ cents gold net, and 10¼a11 cents currency. Manganese Black Oxide 4 cents; Manganese Pyrolusite 5½ cents.

METALS.

NEW YORK, April 25, 1872.

IRON.—Duty: Bars, 1 to 1¼ cents ℔ lb; Railroad, 70 cents ℔ 100 lbs.; Boiler and Plate, 1½ cents ℔ lb; Sheet, Band, Hoop, and Scroll, 1¼ to 1¾ cents ℔ lb; Pig, $7 ℔ ton; Polished Sheet, 3 cts. ℔ lb; Galvanized 2½; Scrap Cast, $6; Scrap Wrought, $8 per ton

	Store Prices.
Pig, Scotch No. 1, ℔ ton	49 00@54 00
Pig, American, No. 1	50 00@51 —
Pig, American, No. 2	49 00@50 —
Pig, American, Forge	47 00@48 —
Bar Refined, English and American	100 00@105 00
Bar Swedes, assorted size (ot)	95 00@100 00
Bar, Swedes	125 00@135 00
Bar, Refined, ¾ to 2 in. rd. & sq. 1 to 6 in. x ¾ to 1 in.	105 00@— —
Bar, Refined, 1½ to 6 by ¼ & 5:16 & 2¼ to 2¾ rnd. sq.	110 00@— —
Bar, Refined, 1 & 1¼ by ¼ & 5:16	117 50@— —
Large Rounds	122 50@127 50
Scroll	122 50@152 50
Ovals and half-round	127 50@137 50
Band	— —@122 50
Horse Shoe	120 00@130 50
Rods, ⅜ to 3-16 inch	112 00@155 00
Hoop	135 00@177 50
Nail rod	8 @— —
Sheet, Russia, as to assortment (gold)	— @ 18 ½
Sheet, Singles, D. and T. Common	—6½@— 7¾
Sheet, D. and T. Charcoal	—7½@— 8¼
Sheet, Galv'd, Nos. 10 to 27	—@— —
" " Nos. 28, and 29	—@— —
Rails, English (gold), ℔ ton	73@75 00
Rails, American, at Works in Pa	83@85 00

COPPER.—Duty: Pig, Bar, and Ingot, 5; old Copper 4 cents ℔ lb; Manufactured, 45 per cent. ad val.

	All Cash.
Copper, New Sheathing, ℔ lb	— @— 46
Copper Bolts	— @— 48
Copper Braziers, 16oz. and over	— @— 48
Copper Nails	— @— 51
Copper, Old Sheathing, &c. mixed lots	— @— —
Copper, Old, for chemical purposes, 14@16 oz	— @— —
Copper English Pig	35 @—37½
Copper, American Ingot	42 @— 43
Yellow Metal, New Sheathing & Bronze	— @— 30
Yellow Metal Bolts	— @— 32
Yellow Metal Nails	30 @— 32

LEAD.—Duty; Pig, $2 ℔ 100 lbs.; old Lead, 11½ cents ℔ lb; Pipe and Sheet, 2¾ cents ℔ lb.

Galena, ℔ 100 lbs	$— @— —
Spanish (gold)	6 12½@6 50
German, do.	6 00 @6 50
English do.	6 25 @7 00
Bar.....(net)	8 50 @— —
Pipe.....(net)	— — @10 00
Sheet	— — @10 00

Colwell, Shaw & Willard Tin-Lined Lead Pipe 15 cts. ℔ lb.

STEEL.—Duty; Bars and ingots, valued at 7 cents ℔ lb or under, 2¼ cents; over 7 cents and not above 11, 3 cents ℔ lb; over 11 cents, 3½ cents ℔ lb, and 10 ℔ cent ad val. (Store prices.

English Cast (2d and 1st quality) ℔ lb	— 16 @— 18
English Spring (2d and 1st quality)	— 7 @— 10
English Blister (2d and 1st quality)	— 10 @— 17
English Machinery	— 11 @— 13
English German (2d and 1st quality)	— 10¾@— 12
American Blister "Black Diamond"	— — @— 12
American, Cast, Tool do.	— 15 @— 16
American, Spring, do.	— 9 @— 11
American Machinery do.	— 9 @— 10
American German, do.	— 9 @— 11

TIN.—Duty; Pig, Bars, and Blocks, 15 ℔ cent. ad val.; Plate and Sheets and Terne Plates, 25 ℔ cent.; Roofing 25. ad val.

	Gold ℔ lb.
Banca	50 @—
Straits	41¼@42
English	41½@42

PLATES. Fair to Good Brands.	Gold.	Currency.
I. C. Charcoal, ℔ box	$13 75 @14 00	$15 00 @15 50
I.C., Coke	12 50 @13 00	14 00 @14 50
Coke Terne	10 50 @11 25	11 75 @12 00
Charcoal Terne	12 50 @13 00	13 50 @14 50

SPELTER—Duty: In Pigs, Bars & Plates,

Plates, Foreign.....(gold).....p. 100 lb.	$1.50 p. 100 lb
Plates, Domestic.....p lb.	.7 12½@ 7 37½
	— 7 @— 11

ZINC—Duty: Pig or Block, $1.50 per 100 lb.; Sheet 2½c per ℔ Sheet..... per lb.— 10½@— 11

San Francisco Stock Market.

BY TELEGRAPH.

The following report from the San Francisco Stock Board is dated the 23d inst., the same terms which we applied last week, viz., a continued and unexceptionable advance of the list describes the present condition of the market. The annexed quotations speak for themselves, and it is sufficient to say that they are higher than were ever known before. As a matter of curiosity, we have appended the report of the Board for last year, a comparison of which, with the report of to-day, shows the remarkable advance which has taken place since then. The following per Telegram, dated the 24th inst. we have received since going to press:

SAN FRANCISCO, Cal., April 24.—The feverish and excited tone of mining stocks, and the rapid advances which have characterized transactions in the Stock Board for some time past, were suddenly checked, and the market weakened yesterday by the receipt of a telegram from New York, ordering heavy sales of some of the favorite mining securities, and a general decline quickly followed its reception.

In the shares of the Potosi and Imperial mines there was a decline of $25 per share: Ophir shares declined $30, and Gould & Curry $25. The heaviest decline took place in the Chollar and Savage mining shares, the former declining $150 and the latter $115 per share.

During the afternoon the market became slightly firmer, and there was a general recovery in price.

	April 25, 1871.	April 19 and 23, 1872
Savage	62	660 @20
Crown Point	168	1325 1390
Yellow Jacket	67½	172½ 280
Kentuck	74	430 495
Chollar Potosi	74	210 280
Gould & Curry	59	440 510
Belcher	54	995 1070
Imperial	35	340 375
Hale & Norcross	—	672½ —
Eureka G. V.	—	32½ —

Mining Stocks.

NEW YORK, April 25, 1872.

The following report from the Mining Stock Board, evinces a decided improvement over our report of last week. The transactions during the week just past, have been more numerous than for a long time past, with a slight advance of the list. The following are the bids for Copper Stocks: Central $37; Calumet $157; Copper F. $16.50; Davidson $2; Hilton $2; Mendota $250; Minnesota $6.75; Rockland $4.

	BID.	ASKED.
American Flag	20	30
Bates & Baxter	40	—
Benton	3	5
Black Hawk	1 20	1 25
Casco Gold	—	—
Central Gold	7	9
Cons Gregory	56	60
Grass Valley	9	10
Gunnell	40	—
Holman	2	5
La Crosse	39	40
Liberty	3	4
Montana	—	—
Rocky Mount		12
Quartz Hill	42	48
Smith & Farm	80	90
Sexax	20	30

Petroleum.

The Petroleum list is nominally unchanged. No sales have transpired during the week; the report is as follows:

	BID.	ASKED.
Bennehoff Run	20	30
Bergen Coal and Oil	—	50
Blood Farm	5	—
Bliven Oil	—	45
Brevoort	1 75	2 50
Buchanan Farm	40	—
Central	—	—
Home	1 30	1 45
New York & Allegheny	1 25	—
Northern Light	30	—
Phillips Pet	5	15
Pithole Creek	—	1 00
Rathbone Oil	20	—
Rynd Farm	25	30
Second National	—	40
United Petroleum Farms	25	30
United States	35	55
Clinton	—	—
National	—	—
Sherman & B	—	—
Tarr Farm	—	—
Webster	—	—

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April 23:3mos T. ELWOOD ZELL, Proprietor.

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The Coal Beds of South-Eastern Illinois, and the Value of Paleontological Against Stratigraphical Evidence.

By HENRY ENGELMANN, E. M., Formerly Assistant in the Illinois State Geological Survey.

IN a treatise read before the late meeting of the American Institute of Mining Engineers, Mr. B. S. LYMAN discussed the importance of surveying in geology, and pointedly remarks that paleontology "may sometimes give more or less trustworthy aid in determining practically the relative age of beds (viz., subdivisions of a formation) but in general it is rather the position of the beds that determines the relative age of the different groups of animals or plants whose remains are found in them; and geology gives to paleontology far more in value than it gets in return. It is absurd, then, for paleontology to assume to be geology, or the chief part of geology, as so often happens now-a-days." I propose to present a striking example which will show how careful we should be in accepting paleontological evidence in establishing or tracing minor subdivisions in the geological formations, unless the same be fully sustained by stratigraphical and topographical evidence. This example will be one of more than ordinary interest to the metallurgist and mining engineer, as it is taken from our coal fields, and may serve to caution them in undertakings involving the expenditure of large sums of money. I am at present in the wilds of Utah, without books and documents for reference, but the following statements are substantially correct, and can at another time be proved by documentary evidence:

In the earlier years of the Geological Survey of the State of Illinois, after much study and extended examination of the outcrops and mines of coal, the State Geologist, Mr. A. H. WORTHEN—a zealous amateur collector of fossils, but not versed in any of the auxiliary branches of science which must be brought into play to make such a survey practically valuable—and Prof. LEQUEREUX, of Columbus, Ohio, determined the Big Muddy bed of block coal as an equivalent of No. 1 B of the Kentucky section of Owen, where it is still placed. In the bluffs of the Mississippi river, opposite St. Louis, they found three coal beds, the lower one a mere streak in sandstone which rests on the subcarboniferous St. Louis limestone, a little higher up a second thin one, and then the bed worked extensively in that district. As this stratum was at this point so near to the underlying limestones, they concluded that it must be one of the lowest strata of the coal measures, and called it No. 1 C, and readily found paleontological proofs to sustain this preconceived idea, and published so, and defended this view for a number of years. They also found a coal bed north of the Big Muddy and southeast of St. Louis, at Duquoin, and placed that considerably higher in the series, and another one farther north, near Carlyle, they pronounced unmistakably identical with the Duquoin bed, all on paleontological grounds.

When I re-examined that district more in detail, I was at once struck with the small probability of this arrangement. Tracing on a map the outcrops of all the most prominent strata of rock, I demonstrated most conclusively that the geological structure of the whole district was a most simple one, that the Big Muddy bed was the lowest one of the three, that the St. Louis bed and the Duquoin bed were one and the same, and that the Carlyle bed was several hundred feet higher in the series. The stratigraphical and topographical evidence could not any longer be gainsayed, and the former paleontological evidence vanished in thin air. Messrs. WORTHEN and LEQUEREUX, apparently loth to completely acknowledge their error, now call the Duquoin and St. Louis beds Nos. 5 and 6, but the internal structure of the stratum, and the quality of the coal of its different parts, prove conclusively, to my mind at least, the full identity of the two strata. It was then that these gentlemen discovered that Mr. OWEN'S Kentucky section contained a duplication of the strata, but my name and agency was never mentioned, nor was I allowed to make a communication to the *American Journal of Science* on this and kindred topics, as this would "anticipate the results belonging to the Survey," which would not do for an assistant, although the principal owed him his position.

I have never before publicly referred to this subject, but consider this example of too much interest to the miner and capitalist to be withheld. It certainly shows how pliable mere paleontological evidence is, and how unsuitable for distinguishing minor subdivisions of the coal formation. Nor is that to be wondered at. Paleontology is a vast science still in its infancy, and especially the paleontology of the coalflora is a difficult study. If we consider how much is still to be learned by the botanist of the structure of living plants which are before him with all their parts entire, it is evident that little reliance can be placed upon conclusions drawn from the observations of some shreds of fern leaves found in the coalslates. The student is just as apt to describe leaves of different parts of the same fern as different species, as to confound different species into one, and of the topographical and chronological range of the species he has only a very faint idea, which may be modified any day by new discoveries. The conclusions arrived at from this source are far too apt to reflect the preconceived views of the scientist, instead of being formed with mathematical precision from proofs before him.

We owe to this Illinois survey some volumes of considerable value to the student of paleontology. The descriptions of new and rare fossils published therein, are the work principally of Prof. F. B. MEEK of Washington, D. C., and of Dr. J. S. NEWBERRY of Columbia College, also of Prof. LEQUEREUX. The names of these gentlemen are a guarantee for the quality of their work. But the chase after new species of fossils entirely overshadowed every other consideration in the execution of this survey, and the practical results are therefore ridiculously inadequate to the time and money spent on its execution. If practical results are desired, the work will have to be done over again.

SALT LAKE CITY, U. T., April 13th, 1872.

The Mineral Resources of North Carolina.

BY F. A. GENTH. *

[CONTINUED FROM PAGE 228.]

Copper.—Copper ores have been found in many localities throughout the State, in the veins of the old gneissoid rocks, as well as in the more recent slates, and even in the triassic formation.

The principal ore is chalcopyrite or copper pyrites; and there is every reason to believe that many of the mines require only a fuller development to enable them to furnish large quantities of valuable ores.

I have already mentioned that many of the gold veins are associated with pyritic ores, and in fact almost all the North Carolina copper mines in the central counties have first been worked for gold, and there are hardly any mines in Guilford, Cabarrus and Mecklenburg Counties occurring in the gneissoid and syenitic rocks, which do not show strong indications of copper ores.

When mining operations receive a new impetus, it is to be hoped that this very important fact will be borne in mind, and that no mine should be started without sufficient means to develop it at once to such a depth that a workable body of copper ores may be reached.

The general character of these mines is that about at water level the so-called brown gold ores are replaced by quartz richly charged with iron pyrites more or less mixed with copper pyrites, the latter increasing as the mine deepens, and in many places becoming the only, or the predominating ore, and forming a regular copper vein.

The ores either became poor in gold or the latter could not be extracted by the ordinary process, then chiefly in use in North Carolina—Chilean mills and arastra—therefore many valuable mines were abandoned, mostly before a larger and paying quantity of copper ores had been reached.

In this formation there is not at present a single copper mine in operation, although many look favorable for further development.

The principal mines which promised to change into copper mines are: in Guilford County, the Fisher Hill, the North Carolina, the McCulloh, Lindsay, Gardner Hill, Twin Mines, etc.; in Cabarrus County, the Ludowick, Boger, Hill, Phœnix, Orchard, Vanderburg, Pioneer Mills, etc., and in Mecklenburg, the McGinn, Hopewell, Rudesill, Cathay Mines, etc.

The cupreous minerals observed in these mines are, near the surface, small quantities of native copper and cuprite, the latter sometimes in beautiful needles, the so-called chalcotrichite, malachite, rarely azurite, chrysocolla and pseudo-malachite, and in some of the mines chalcocite and barnhardtite; all resulting from the decomposition of chalcopyrite or copper pyrites, which form the principal ore. Siderite or carbonate of iron often forms an important gangue rock.

A very important copper region extends through many of the western counties of North Carolina, which is best developed in Jackson, Wautauga, Ashe, Wilkes and Alleghany Counties. The ores occur in hornblendic slates and gneissoid rocks.

In Jackson County, at the Savannah, the Cullowhee, the Wolf Creek Mines and others, large quantities of chalcopyrite or yellow copper pyrites have been obtained; at Elk Knob, in Ashe County, the ore consists of chalcopyrite with pyrrhotite, in a gangue rock consisting of a dark colored micaceous quartzite. The Ore Knob in the same county has furnished chalcocite or copper glance.

At Gap Creek Mine, in Wilkes County, the ore consists of quartz with bornite or variegated copper ore and chalcopyrite. The ore sometimes contains silver and gold.

The Peach Bottom Mine in Alleghany County has been worked to a depth of 150 feet, and has produced a considerable quantity of ore; galenite occurs in a portion of the vein.

This whole mining region is well worthy the attention of capitalists, and when better facilities for transportation are offered, I have no doubt that it will be more fully and profitably developed.

The only two copper mines in North Carolina, which are worked at present to a limited extent, are in the so-called taconic slates.

The Clegg Mine in Chatham County is a large quartz vein in argilaceous slates. It is developed to a depth of 200 feet and has furnished large bunches of valuable ore. The ore is chiefly chalcopyrite, but other cuprose minerals have been found, among which azurite in small but beautiful crystals. The mine is in excellent order, and the machinery is of the best quality and very efficient. I understand that arrangements have been made to smelt the ores on the spot. Copper ores, under similar circumstances, are found at other places in Chatham, also in Person County.

The other mine is the so-called Emmons or Davidson copper mine, about six miles from Lexington. It has also been opened as a gold mine, but the ore was poor, containing not over thirty-seven cents per bushel, with a large admixture of iron and copper pyrites, occurring in a dark bluish green chloritic slate. It has been abandoned therefore as a gold mine and is worked only for copper. I learned a few days ago that works for the extraction of ore by the humid way are in contemplation.

Almost identical in appearance, but richer in gold, is the so-called Barnhardt vein of Gold Hill. In the neighborhood of Gold Hill are several localities which have yielded rich copper ores; especially the Union copper mine in Cabarrus, about one mile from Gold Hill; it was worked more than any other in the neighborhood, and has furnished crystallized copper and cuprite, and a mixture of chalcocite and chalcopyrite and other ores.

Other mines in the neighborhood of Gold Hill, also several in Randolph and Davidson Counties, contain more or less copper; for instance, the Conrad Hill shows strong indications of copper.

* From the Journal of the Franklin Institute.

THE ENGINEERING AND MINING JOURNAL.

ROSSITER W. RAYMOND, Ph. D.,
WILLARD P. WARD, M. E.
Editors.

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Office Removal.

We desire to call attention to the removal of our office from its present location to No. 27 Park Place, which will take place on May 1st.

Phillips on Mining and Assaying.*

WE have kept this work by us for a couple of months, before giving it an editorial notice, in order to examine its merits candidly—a work of some difficulty, since the first impression it produced upon us was decidedly unfavorable, for several reasons. The original object of the book was to advertise an assaying apparatus, called the "Wee Pet Assaying Machine," for sale by the author; and though the work has been extended to cover many other topics, this object is still unpleasantly prominent. Moreover, Mr. PHILLIPS is not an educated writer, nor thoroughly posted in the theories of geology, etc., which underlie the practice of his profession. Consequently, he is apt to generalize foolishly, and in bad English. Nor is his declaration, that he writes for practical men only, and does not challenge scientific criticism, to be accepted as a complete excuse. Practical men may be satisfied to get dogmatic directions only, without theories or explanations; but they do not want to be stuffed with wrong theories or puzzled with obscure ones.

These features of the book naturally inclined us to an unfavorable opinion of its merits; but our attention was caught by so many passages, even in the weakest chapters, indicating good sense, keen observation and large experience, that we have given the whole work a patient examination, and take pleasure in saying that it is a contribution to our mining literature of real value, not only to common miners and prospectors, but also to professional engineers. We can forgive the author for writing of some matters which he does not understand, in consideration of the excellent things he has said of matters he does understand.

The book is divided under the following heads: 1. Geology and Mineralogy; 2. Exploration; 3. Assaying and Discrimination; 4. Mining and Engineering; 5. Metallurgy. The first of these is open to severe criticism, as neither clear nor accurate, though it comprises some valuable remarks, particularly on the reactions in veins. Much of Mr. PHILLIPS' talk about fissure veins, we must add, is based on Cornish precedents, which do not hold good all over the world. We infer, though we know nothing on the point, that he is a Cornish mining captain. His judgment of contact veins, cross-courses, signs of increase in depth, and other points, is evidently warped by this local experience.

The chapters on Exploration are excellent, barring the rhetoric and the theories. If such stunning paragraphs as the following had been omitted, considerable expense in printing would have been saved—and letters would have lost little. We quote from page 109:

"After the discovery of the rich Comstock ledge, on the eastern verge of the Sierra Nevada, it was not strange that bold prospectors, favored by a magnificent climate, should have been infatuated and enticed forward into the far interior, for the prospection of the unexplored land, that loomed, with all its distant, enchanting grandeur, and rosy beauty, before them, as mountain after mountain arose, with irresistible enticements, in unprecedented states of virgin nudity and apparent nearness, that solicited and facilitated their examinations, by the miner, to an extraordinary dêgree."

The *facts* here are correct enough, but the figures are, so to speak, rather potipharitic. Does Mr. PHILLIPS think his readers cannot blush? One more example we will give, to show with what disregard of expense our author "slings his ink"; and then we shall forbear further ridicule, even in the mild form of quotation, because it will be a fairer and pleasanter task to point out the really good qualities of his book. In fact, we would spare his rhetorical faults altogether, but for a conviction that he prides himself on just those passages which most obscure the merits of his work. On page 112 he says:

"In the preceding chapter, some generally observed principles have been analogized as to the more probable positions for the profitable plenitude of the minerals of this country; which I will now endeavor to more directly elucidate (so far as words will be understood), for the practical guidance of prospectors."

It is fortunate that when Mr. PHILLIPS stops analogizing and elucidating, he drops in a friendly way into very sensible and suggestive talk. If his eloquence were absolutely continuous, we should have much less to say of him.

The section on assaying naturally contains a good deal about the "Wee Pet" machine, or portable apparatus. This seems to us to be well adapted for use in the field. The smallest details have been worked out to perfection, and great compactness and completeness are the result. The practical directions for the rapid approximate determination of the value of ores are very good; and the general outline of the whole subject of assaying is well-arranged for the purpose in view.

We notice one statement which may mislead the unlearned operator, namely the directions in pages 192 and 193 for the qualitative silver test (precipitation with hydrochloric acid or salt from a nitric acid solution). It is not sufficiently explained that lead chloride may be here precipitated, if the acid is dilute, and mistaken for silver. "Chemically pure" nitric acid is indeed prescribed; but purity may be understood not to include concentration. On page 191, the behavior of lead is correctly given. Chapter VI of this section, containing an alphabetically arranged list of minerals, describing their behavior under the action of water, heat, and reagents, and giving the distinguishing test for each, is plain in language and most useful to the prospector.

The section on mining and engineering (150 pages) is necessarily not detailed in its treatment of this very large topic. Ore-dressing is discussed in a scanty and one-sided way, and with a strong Cornish accent, which indeed pervades the whole section, more or less. Nevertheless, though Cornish practice is not exactly the most advanced and perfect, it is far ahead in many respects of the rude and wasteful methods of our newer districts, and its example is not to be despised. Mr. PHILLIPS' enumeration in Chapter X of the more frequent errors in American mining management, is a just and timely warning to capitalists and mine-superintendents.

The section on metallurgy is not positively bad; but it is hopelessly behind the age—say about thirty years. In the discussion of roasting, no mention is made of the latest and most approved processes and apparatus; under smelting, a strong preference for the reverberatory, and an utter disregard of the shaft furnace is displayed. Mr. PHILLIPS appears to be ignorant that the Piltz, Raschette, and still later combination shaft furnaces have revolutionized metallurgical practice, and that they are even more decisively superior to reverberatories for smelting in this country than in Europe. He does not mention them, but quotes Dr. URE, who is dead and out of print. The chapter on milling is good; the description of chlorination is apparently condensed from KÜSTEL; the PARKES' zinc-desilverization process gets a single unsatisfactory page, though it is at this moment greatly interesting the metallurgical world; and the improvements of FLACH, CORDURIÉ and others are not mentioned.

To sum up this analysis of the book, we must say that, with all its defects, it is the best single English treatise we know for the use of prospectors and practical miners. It conveys to them a large amount of useful information, otherwise almost beyond their reach. Educated mining engineers and metallurgists will find in these pages, not indeed a complete and thorough professional manual, but a large number of useful hints and observations, drawn from practice, and not usually met with in scientific books. The author apologises at the close for errors in style, saying that his life has been "too peculiarly operative for any correct expression or refined language," and that the work was hastily written in eight months. The apology is misplaced. Mr. PHILLIPS' plain talk is very good, both to practical and to refined people. It is his fine writing, and his theoretical fantasies that make him unnecessarily ridiculous; he should have written the book in six months, and left these portions out.

* THE EXPLORERS', MINERS' AND METALLURGISTS' COMPANION, *Comprising a Practical Exposition of the Various Departments of Exploration, Mining, Engineering, Assaying, and Metallurgy.* By J. S. PHILLIPS, M. E. San Francisco: DEWEY & Co. 1871.

New Publications.

AN ELEMENTARY MANUAL OF CHEMISTRY. *Abridged from* ELIOT AND STORER'S *Manual, with the Co-operation of the Authors. By* WILLIAM RIPLEY NICHOLS, *Assistant Professor of General Chemistry in the Massachusetts Institute of Technology.* New York: IVISON, BLAKEMAN, TAYLOR & Co., 1872.

The manual of ELIOT and STORER treats of inorganic chemistry only. This abridgment of it is in

that respect an enlargement, since it comprises three chapters on the organic combinations of carbon, constituting a general outline of organic chemistry. In its present form, it is a convenient and generally well-arranged text-book for instruction by the inductive method. Perhaps it is somewhat deficient in the thorough grammatical element, so to speak—the paradigms and rules of the science—which cannot well be omitted as a means of drill, however they may be disguised in the flowery garb of object-teaching. For instance, we do not find quite enough of chemical philosophy and stoichiometry in the volume. What little is said on the subject of formulas is unsatisfactory, and inserted in a queer, out-of-the-way place, at the end of the chapter on phosphorus. A preceding chapter treats in a clear style of the subject of combination by weight; but of provision for training the student in the calculations based on chemical formulas, we find very little. On the other hand, the arrangement of the book is pretty well adapted to progressive instruction, and a fair index renders it available to some extent for rapid reference. The appendix, containing tables of weights, temperatures, etc., and directions for laboratory work, is excellent.

ASTRONOMY AND GEOLOGY COMPARED. By LORD ORMATHWAITE. New York: D. Appleton & Co., 1872.

The author of this book is an English peer, who was for many years (as Sir John Walsh) in the House of Commons, retiring from public life in 1865. He is now seventy-four years old, and nearly blind, and he dictated to an amanuensis these three essays, the first of which gives its title to the book, while the two others treat respectively of "The Theories of Mr. DARWIN and Mr. BUCKLE," and "Progress and Civilization." The circumstances of their authorship are calculated to disarm criticism. One would not be severe upon the mental recreations of an old man; yet the publication of his thoughts is scarcely a part of the occupation that has alleviated his loneliness, and their republication in this country is fairly to be considered a challenge to criticism, since it is certainly an invitation to purchase. We are bound to say of them, if we say anything, that they are eminently well meant and common-place, revealing neither special knowledge nor original interpretations of the facts of science and history. The argument against DARWIN and BUCKLE is a disguised use of the *odium theologicum*. The essay on Progress and Civilization contains a good deal of eulogy of the Anglo-Saxon race, infused with observations, strongly overdrawn, of the weakness and wickedness of all other stocks, particularly the Asiatic races, of whom my lord says many severe things, out of the dogmatism of his own ignorance.

SCIENCE PRIMERS: CHEMISTRY, *by* PROF. H. E. ROSCOE; PHYSICS, *by* PROF. BALFOUR STEWART. New York: D. Appleton & Co., 1872.

These little books belong to a series, prepared by eminent English scientists, and designed for primary instruction. The two before us are in many respects excellent, as the reputation of their authors would lead us to expect. We note here and there, however, indications of the laborious attempt of great minds to be simple, evinced in unnecessary conversational phrases, which cumber the text, and have caused the omission of more useful matter. We refer to such expressions as "Let us now proceed," "You probably know," "If you reflect a little, you will understand," etc., etc., ushering in the announcement of a fact, which could as well be stated at once. A still worse kind of "simplicity" is Professor ROSCOE'S statement (p. 43) that "Fire is the heat given off when bodies burn or combine chemically." SIMPLE SIMON himself would know better than that. A definition of fire that does not include light as well as heat, is false. Professor STEWART sins in the same way, when (p. 91) he describes the transmission of light as a blow given from particle to particle after the manner of a blow passing through a row of ivory balls suspended in contact. The illustration, as first used by him to describe the propagation of sound, is correct. When he recurs to it as an explanation of the waves of light, he confounds the distinction of kind between light and sound. The exposition is simple in one sense—it is simply absurd. An undulating rope, or a wave in water, would have furnished an illustration equally comprehensible and much more accurate.

HOW THE WORLD WAS PEOPLED. *Ethnological Lecture by* Rev. EDWARD FONTAINE, *Professor of Theology and Natural History, etc.* New York: D. Appleton & Co., 1872.

The author of this book is a firm believer in the unity of the human race, and its descent from a common origin; but unlike many modern naturalists who hold this view, he adheres to the literal interpretation of the Scriptural account of that origin, so far as it makes Adam and Eve a specially created pair, the parents of all nations. He does not even discard the accepted chronology (Usher's), according to which the date of man's creation was 4004 years only before the Christian era. At the same time, he does not carry this literal interpretation so far as to deny the indefinitely great duration of the earth, and of life upon it, before the appearance of man. The doctrine of the development of species by descent and modification he treats with ill-judged contempt (p. 56) not deigning to include it among the objections to the story of Adam and Eve. In a note, however, (p. 88) he is more respectful towards it, and goes so far as to say "There is nothing in a correctly-stated theory of evolution or development opposed to the biblical account of the creation."

As a whole, Mr. FONTAINE'S argument, though containing some ingenious passages, is a failure, by reason of its defective method. The manner in which he deals with the accumulated evidences of the antiquity of man is little short of disingenuous. It is quite true, as he declares, that geologists and archaeologists are not able to fix the precise age of the most ancient relics found in the drift, or in caves and mounds; but it is not true that these evidences are reconcileable with an antiquity of no more than 6,000 years. In quoting LYELL, MIVART, AGASSIZ and DANA against DARWIN, he invokes spirits too powerful for him to deal with. Thus AGASSIZ distinctly connects his hostility to Development with his disbelief in the single origin of the human race, and LYELL is one of the strongest representatives of the doctrine of the great antiquity of mankind. Nor should it be overlooked (as seems to be frequently done by clergymen discussing this subject) that DARWIN'S chief opponents do not deny the development of species—even of man—by descent. They dispute only the range which he gives to natural and sexual selection as adequate agents in that development, and they are just as much committed to the notion of a connection between men, monkeys and a common ancestral species, as DARWIN himself is. The fact is, Mr. FONTAINE is trying to defend the unity of the race—a very probable and tenable hypothesis—on grounds which, if accepted, would overthrow it altogether.

The final chapters in the book, one on the Aboriginal Inhabitants of America, and one on the Physical Geography of the Mississippi, are the best. The latter in particular is an interesting description of the climatic, topographical and other features of the great valley, the river and the delta. The constant use of italics for emphasis in this book is a piece of bad taste, which the publishers should have corrected.

American Institute of Mining Engineers.

OFFICIAL BULLETIN.

Announcements to Members and Associates.

I. It is believed that several names of members and associates elected at the Bethlehem meeting in Aug., 1871, have been accidentally omitted by reason of the loss of a portion of the records of that meeting. Such persons, or their friends, are requested to communicate with the Secretary.

II. All members and associates who have not paid their dues are requested to do so at once, by sending in postal orders, or check, or money, ten dollars to the Secretary.

All members and associates who pay their dues for each current year, strictly in advance, will have sent to their address, regularly and weekly, the ENGINEERING AND MINING JOURNAL, which is the organ of the Institute, and will contain the proceedings and transactions, and all important papers read before the Institute, and all notices of meetings. Back numbers cannot, as a general rule, be sent.

III. It is expected that the more important papers read before the Institute, and the debates thereon, will be published in annual or semi-annual volumes to which those members and associates will be entitled who have paid their dues.

IV. Authors of papers are requested to notify the Secretary in advance of the meetings, giving the subject and length of their papers. Attention is also called, in this connection, to Rules 12 and 13.

The annual meeting of the Institute will be held in the city of New York, commencing on Tuesday evening, May 21st, at 8 o'clock, in the Cooper Union Building, at the head of the Bowery.

About-Town Jottings.

BUSINESS AND PERSONAL.

Personal announcements and business notices inserted in this column, at fifty cents per line.

Root's Wrought Iron Sectional Boiler, manufactured by the Root Steam Engine Co., 500 to 510 Second Avenue, New York.

Geo. F. Blake & Co., 79 Liberty street, Steam Pumps of every size and capacity, for all purposes.

Utica Steam Engine Co. (formerly Wood & Mann Steam Engine Co.,) 42 Cortlandt street, N. Y.

Post & Goddard have removed to No. 111 Liberty street. Dealers in Taps, Dies, Reamers, Drills and supplies generally.

American Submerged Pump. Power attachment—cheapest and best in the market. 55 Chambers street, N. Y.

Roper Caloric or Hot Air Engine, 124 Chambers St.

Blake Bros., New Haven, Conn., manufacture Stone Breaker for crushing ores and minerals of every kind into small fragments, preparatory to their further comminution by other machinery.

Polytechnic Association of the American Institute.

Meeting held March 15, 1872, President TILLMAN in the chair.

The President read the following notes of scientific progress:

I. BESSEMER'S GUN.—In the improved plan for heavy ordnance by Mr. BESSEMER, the initial pressure is reduced by having a series of smaller charges ignited successively as the shot travels along the bore of the gun. This is, however, the essential feature of the American gun patented by Mr. A. S. LYMAN. In order to secure the greatest benefit from this method of applying force, Mr. BESSEMER proposes to increase the length of the gun to 50 feet. It is to be made of wrought iron tubes, connected by flanges and strengthened by steel rings. Rotation is to be given to an elongated shot, not by rifling the bore of the gun, but by the reaction of powder gas issuing in small jets through tangential orifices at the circumference of the shot. The shot is to be made hollow, and contain the charges of powder required to rotate it. The objections to Mr. BESSEMER'S "improvements" are so grave that it may be doubted whether he will carry them into practice.

Mr. STETSON—The objection to the use of long guns consists in the impression of the air ahead of the ball. When the gun is short the air can get away laterally without much resistance, but when the tube is long there is a point beyond which the resistance will become considerable. Experiments have shown that shortening the barrel of an ordinary gun from six feet to five will increase the force of the charge. When you fire with steam you can have a longer gun, but with powder you can get all the velocity from ten or fifteen feet that you can ever get.

THE PRESIDENT—The principle of Mr. LYMAN'S gun is simply this, not to give the ball at first its full velocity. It is the same principle that is applied to the bow and arrow. The bow being upon the principle

of the toggle joint the swiftest motion is at the end of the motion of the string, so that the velocity is increased all the time until the arrow leaves the bow. Mr. LYMAN found that if the full power was applied at first there was danger of the gun exploding. He, therefore, fired a small charge at first, and afterward successive charges, propelling the ball faster and faster until it left the gun. In theory this is very beautiful. A gun made by Mr. LYMAN is said to have carried a ball ten miles, which is much further than was ever known by any other process; but LYMAN'S gun has never been brought into use although it was invented before our Rebellion.

Dr. VAN DER WEYDE—Different explosive powers differ chiefly in the time it takes them to burn. Take an explosive powder that is slow in burning and we may use a long gun; but if it ignites very quickly we must have a short gun. That is the danger of bursting a gun in using fulminating powders. It is the virtue of ordinary gunpowder that it burns slowly. If you want long guns you must make the powder burn more slowly. I do not see the necessity of having successive charges.

THE PRESIDENT—It is almost impossible to get powder that will burn slowly enough.

Dr. VAN DER WEYDE—We may make it burn as slowly as a fuse. We make a pound of powder burn in a tenth of a second, or a twentieth, or a hundreth, or a thousandth; but in that case it would be equivalent to a fulminating powder. It is only the rapidity of the burning which gives the power to dynamite and nitro-glycerine. It is the difference between a push and a sharp blow of the hammer. Some fifteen years ago I advised Prof. MAILLEFERT to use fulminating powders in surface blasting at Hurlgate; but he said gunpowder was dangerous enough, and he was afraid to use anything stronger. Now the stronger materials are found much more economical, and are almost universally used. Gunpowder will only blast out near the bottom of the hole which is charged, but dynamite or nitro-glycerine will crush the rock many inches beyond the bore. Prof. DOREMUS has made gunpowder in a solid mass weighing ten or twenty pounds to fit the bore of the gun. I do not know what was its practical success.

Mr. WEIR represented upon the blackboard the Lyman gun and the Bessemer gun. He said the Bessemer gun never was made, never would be made, and never would work if it was made. The powder made by Prof. DOREMUS was not really solid but was of a honeycomb structure.

Mr. FISHER—There is a superstition that it is dangerous to fire a gun when the ball is not rammed home. I think it is worth while to try whether leaving a sufficient place, so that there would not be pressure enough to burst the gun, would not produce good results. Gun-cotton, for instance, might be used with an air space.

Mr. GREEN—That is out of the question. It upsets the shot and deranges the particles of metal in the gun. If you should have a large chamber of air there is no material that could resist the blow. Many guns have been burst in that way.

Dr. VAN DER WEYDE—What Mr. Fisher proposes cannot but be injurious. When the powder commences to ignite it finds the ball at rest, and should immediately act upon it, and commence to set it in motion; but if the ball is at a little distance a considerable part of the powder ignites before its effect reaches the ball, and then it acts with a blow.

Mr. FISHER—I do not see why there should be a blow when there is a cushion of air there to prevent it.

Mr. RAYNOR—It is the experience of gunsmiths that when double-barreled sporting guns are sent for repair, in a large proportion of cases the left-hand barrel is burst. The reason appears to be this: It is most natural to discharge the right-hand barrel. The jar starts the bullet in the left-hand barrel and produces a little space behind it. The right-hand barrel is loaded and fired several times, each time increasing the effect. At last the left-hand barrel is fired and an explosion takes place.

Mr. WEIR—If the shot is next the charge the first pressure upon it is, perhaps, 30 pounds to the square inch; if it is placed off further the first pressure may be two or three times as great.

II. GUNPOWDER GAUGE.—The principle suggested by TRESCA'S experiments on the flow of solid bodies, has been applied by M. le Commandant de Reffye to the determination of the pressure in the bore of large guns. A cylindrical hole, bored into the gun, is filled by a block of lead, supported behind by a steel block, through which is a small cylindrical hole. When pressure acts on the lead, a portion of it is forced into the hole in the steel block. The volume of lead found in the cylindrical cavity after the gun has been fired is the measure of the pressure in the bore of the gun.

III. EFFECT OF FASTING.—Prof. SEEGAN has communicated to the Viennese Academy of Science the results of investigations upon the metamorphosis of tissue during fasting. The subject of his experiments was a young girl, who, in consequence of a stricture of the esophagus, was only able to consume very small quantities of nourishment. During a whole month her daily food was but 35 grammes of milk and about twenty cubic centimeters of water. A teaspoonful of this mixture was taken every hour. After lasting four weeks the difficulty of swallowing gradually disappeared, and the quantity of milk taken daily rose to 210 grammes. The author gives a full account of many interesting results obtained, only one of which need be here stated, namely: that the metamorphosis of the albuminates, which was principally supplied from the muscles, so far as measured by the excretion of urea, during fasting, bears the proportion to the normal metamorphosis of 1:4 or 1:5.

IV. THE FLOW OF LIQUIDS.—Prof. COLDING gives, in the "Copenhagen Transactions," his investigations of the law of the motion of water in pipes and conduits, and has also applied his results to ocean currents. His method is to determine the motion of liquid threads, that motion varying with the depth when water flows over a plane surface. The formulæ now generally used are founded on the assumption that water moves in plane layers at uniform velocity. These formulæ are known to be defective.

V. MANNA.—BOUSSINGAULT has given to the Paris Academy of Sciences an account of his observations on a manna obtained from the leaves taken from near the top of an old linden, in the Vosges. Other trees of the same kind in the vicinity yielded no manna. The composition of this manna was found to be about 55 per cent. of cane sugar, 26 of glucose, and 20 of dextrin. The manna from Mount Sinai, examined by EHRENBERG and BERTHOLET, had nearly the same composition, and was supposed to be an exudation caused by the puncture of an insect.

The remainder of this day's proceedings we have already published.

MINING SUMMARY.

California.

PLACER COUNTY.

We are indebted to the *Scientific Press* for the following extracts from a correspondence in the number of April 13th.

SUMMIT MINING CO.

Leaving Little York, and going eastward, the first claim is that of the Summit Mining Co., situated 1½ miles west by south from Dutch Flat. This company's possessions cover an area of 50 acres of mining ground and 190 more of timber land, all of which is covered by United States patent, the first ever granted to a gravel mining claim under the law of Congress. It is owned by eight equal partners, JOHN RABLIN is superintendent and CHAS. VOIGHT is secretary. The improvements consist of 1½ miles of 14 inch pipe and 600 feet of 4-foot flume 2 feet deep, with 5 undercarrents; the claim is better located for using the latter than any other on the flat. Working two of HOSKIN'S Little Giant monitors, with 3½ and 4-inch nozzles, running 350 inches of water under 175-feet pressure: 125 feet more pressure will be added to this after the first of next month. Four hundred feet fall is had from their flume to the lowest undercurrent and 200 feet more of dump is obtained from there to Bear river where the tailings fall. This claim is one of the few that is being cleaned to the bed-rock as they go along, and the profits are satisfying to its proprietors. Still going eastward we meet a number of

OTHER GRAVEL CLAIMS,

the first of which is known as the Kidder claim, consisting of about 10 acres of ground, located on the south side of Dutch Flat Canon. Jehosaphat claim comes next and is owned by the Dutch Flat Water Co. and H. C. KELSEY. This claim consists of about 15 acres of mining ground working regularly 4 or 5 men and two monitors. Palmtag claim, next in order, is owned by the gentleman after whom it is named, who is working three men and using one monitor. C. STRAUDE'S claim is an excellent claim containing 27 acres, working 3 men and one Little Giant monitor. The Chinese claim, called the American, is owned and worked by Chinamen. They own 12 acres of mining ground and employ regularly from 5 to 6 men and run one monitor.

DUTCH FLAT BLUE GRAVEL MINING CO.

This is an incorporation with 40,000 shares and $4,000,000 capital. The company's possessions consist of 27 acres of mining ground, covered by United States Patent. The water used is purchased of the Yuba Ditch Co., and they are at present running 200 inches through two 6-inch nozzles, of HOSKIN'S Little Giant monitors, under a pressure of 400 feet, and by the time this is in type will be running under a pressure of 460 feet. Two more 8-inch nozzle monitors have been ordered, through each of which they expect to use 2,000 inches of water. In addition, their improvements consist of 2,500 feet of 30-inch pipe and 1,500 feet of tail flume 5 feet wide and two feet deep, with three under currents. They employ about 70 men. This is the largest enterprise in the State and they are at present using more water than any similar claim in the country. Several important blasts have lately been put off in this claim in one of which 700 kegs of powder were used; 14 chambers were drifted for the purpose, and it was fired by electricity. Using at present both black and Giant power. This company have in project a bed-rock tunnel 1,500 feet in length for which they have ordered a "Diamond Drill." Up to the time of my visit to this mine, since being opened so systematically by its present owners, no clean-up has been made. It is not, however, to be supposed that an extensive clean-up could be made when they have only been washing top dirt, but the ultimate success of this mine is only a matter of time, for when it is thoroughly opened it will surely pay handsome dividends. The bed-rock under the principal portion of the channel in this claim has never been reached but they have a known depth of gravel of 150 feet, and the top gravel is 2,000 feet wide.

Columbia Gravel Claim, owned by SIMMONS & Co., is the next adjoining the above and consists of 10 acres of mining ground where they are working 4 men with 2 Little Giant monitors. The claim is paying satisfactorily.

GOLD RUN,

located four miles nearly west of Dutch Flat on the line of the Central Pacific Railroad, contains about 800 inhabitants and is now one of the busy mining towns of this county. Surrounding the town are a larger number of paying claims now working than at any other camp in the county. Beginning at the most southerly of these claims distant 1½ miles southeast of the village is the Cement Mill Co. The company's possessions consist of a bed of hard cement 1,600x400 feet, and 9 feet thick. In their improvements is comprised an 8-stamp mill, run by water power which can crush about 40 tons per day, and which is now running to its full capacity. The average pay is about $4 per ton. They are at present engaged in drifting in a breast 100 feet wide, and are in 400 feet. Benches are left to support the mass above and but very little timbering is done. Working on an average 20 men. The claim is owned by 8 equal partners of whom JOHN N. JENSEN is Superintendent. The next claim passing northerly is the

STEWART & SNEFF,

a rim rock claim, owned by gentlemen of the same name, which is nearly worked out except some back bottom gravel that will not at present pay to work. They are using one of Hoskin's monitors. After one more run of 30 days this claim will temporarily be laid up. It has paid its owners satisfactorily.

The Brink's and Hawkin's claims are the next two met in passing in the same direction and adjoining the above on the northeast. They are not at present working but are considered good claims in this vicinity.

THE INDIANA HILL CLAIM,

owned by JUDD, BROWN & MINER, is a very extensive claim of about 40 acres, situated right on the channel adjoining the above. It is at present being vigorously worked, using two monitors, running 500 inches of water, and working 6 men night and day. It pays as well as any mine in the vicinity.

GOLD RUN HYDRAULIC M. CO. (LIMITED).

The property owned by this company was formerly known as the "Cedar Claim" and consists of about 37

acres in the heart of this mining section, the channel running the entire length of it. A deeper deposit of blue gravel is found here, probably, than at any other point on this celebrated channel. This property has recently been purchased by an English Co. for the sum of $60,000; the principal office is in London. O. S. KIPP is general superintendent. This company own no ditches but are purchasing their water for hydraulic purposes. Their improvements consist of about 1,400 feet of flume 4 feet wide by 2 feet deep, blocked the entire length. The flume has a grade of 8 inches to 12 feet. They also have 1,500 feet of 16-inch pipe and the same amount of 11-inch pipe; working two Little Giant monitors with 4 and 5-inch nozzles using 500 inches of water under a pressure of 240 feet. Their present working is at least 125 feet above bed-rock with a bank of gravel above and facing them 215 feet high. The northwest line of this company's claims is within ¾ of a mile of Gold Run station. Six men are employed night and day. The average yield for thirty days' run has been from $6,000 to $8,000. A sufficient amount of pay gravel is in sight in this claim to last for the next 25 years with the present method of washing.

GOLD RUN MINING CLAIM,

located about one mile east of Gold Run station and adjoining the above on the north-east is owned by E. L. BRADLEY and W. H. KINDER. H. C. KELSEY is the present superintendent and lessee. The claim consists of 40 acres of mining ground on the main channel and their improvements are 650 feet of bed-rock tunnel that cost $30 per foot to construct; also 1,300 feet of bed-rock flume (being doubled through the tunnel) 4 feet wide by two feet deep. They have 1,600 feet of 30-inch, and 900 feet of 16-inch pipe. Working two of HOSKIN'S Little Giant monitors of 3½ and 4 inch nozzles, lead pipes 11 inches in diameter, carrying 640 inches of water under 325 feet pressure. Working regularly 12 men night and day. The bank of pay gravel at present facing them is 130 feet high and fully 150 feet above bed rock; average receipts $6,000 per month. Making semi-monthly runs. There are a number of

OTHER CLAIMS,

all of which are considered first-class, and most of which are at present working, as follows: Sherman, owned by FITZPATRICK; Newark, owned by Miners' Ditch Co.; TAYLER & HARRIMAN'S; FRANK SACH'S; BEALE & Co.'s and the HAWKINS', all of which are extensive claims. The following are owned by the Dutch Flat Water Co.; Gold Run, Golden Gate, Union, Pacific, Ellison, Gem, Schuylkill and Central, all of which are extensive and most of them being worked with good profit.

Idaho.

From the Owyhee *Avalanche* of April 13.

MAHOGANY.

The 5th level cross-cut, after being run east a distance of 20 feet, intersects the ledge which has a very fine appearance, 18 inches in width, with ore that will mill fully $60 per ton. The quartz is of a soft nature, the walls are well defined, and on the casings each side, very rich silver and gold bearing rock is found. The drifts are being extended both north and south, and are worth fully $45 per ton lineal measure for mining ground. Driving is worth from $6 to $7 per foot, so that this level will pay a good profit from the start. At the 4th level, 15 feet from the cross-cut south, a winze is being sunk in which there is a ledge of first grade ore, 16 inches wide, showing plainly that the shoot of ore runs clear through the 5th level. The foreman expects to have this winze down and stopes running in the back of the 5th level inside of a month. The old stopes in the back of the 4th level, both north and south have also improved. There the ledge is much harder and the rock coarser, sending to the War Eagle Mill 15 tons daily; and as soon as the winze is through to the 5th level, from 20 to 25 tons will be taken out every twenty-four-hours. In the south drift, 4th level, the ledge is small and split up, so that it has been found necessary to run in the west wall in order to keep on the vein, but it looks as if it would improve. From general appearances, we are of the opinion Superintendant MINEAR is safe in his predictions that he will be enabled to pay back the money that has been expended on the mine with interest; for, according to our belief, the Mahogany never looked as well as it does to-day.

SOUTH CHARIOT.

As many men as can profitably be worked are employed in straightening the shaft from the 2d to the 4th level. The foreman thinks it will take him till some time in May to complete this job; but in a few days he will commence sinking on the vein below the 4th level in connection with straightening the shaft above. The ledge in the 4th level drift is large but not of sufficient good quality to save for milling. Still we have no reason why this mine, although abandoned for a time, should not rank as first class, if properly developed. The stopes in the Mahogany mine have been worked up to within a few feet of the lines, and show a fine body of ore, which must of course, extend into the South Chariot, and we believe that, when a sufficient depth is attained, this mine will compare favorably with the Mahogany, or any of its neighbours.

MINNESOTA.

The stopes between the 1st and 2d levels, both north and south of the shaft, continue good, sending out 14 tons of good grade ore every twenty-four-hours. The 2d level drift is run south 180 feet, ledge 2½ feet wide, all good pay and opening out some first class stopes. The north drift is run 184 feet, showing the ledge for the last 6 feet to be badly split up. So that for the present we can attach no value to it whatever. The water has been taken out of the shaft and preparations are being made for running 3d level drifts. The foreman says he will start them to-day. This mine has about 475 tons of ore at the Ellmore mill, and 100 at the War Eagle, awaiting reduction, the whole of which is figured at about $55 per ton. Working force at the present time, 32 men.

GOLDEN CHARIOT.

Although Superintendent PHEBY has gone to San Francisco, yet the work of straightening the shaft is being carried on in the most expeditious manner. The foreman informed us that he had run the dirt out of all the stopes and could now see clear through from the 2d to the 8th level, and will soon commence timbering for the new shaft. The winze in the bottom of the 8th level continues about the same as reported in our last.

ELMORE.

The Elmore shaft is once more on its downward course. A large tank has been just put in at the 7th level, and all the water at this point is taken into it. The Superintendent thinks he will not be bothered much in sinking as there does not appear to be much water in the ground, and the shaft is being pushed down as fast as six good miners, with single-hand drills and Giant power can do it. The 7th level drift north has improved during the past week, showing a ledge 2½ feet in width of ore worth from $40 to $45 per ton. The stopes in the back of this level continue about the same, ledge varying from 18 inches to 2 feet in width. The ore is not of very high grade, but there seems to be an abundance of it, which we think can be profitably worked, and MINEAR informs us he intends going right after it, and, as soon as the roads get open, to keep his mill running on ore from this mine night and day. The winze in the bottom of the 7th level has been sunk 55 feet in a splendid body of ore; the ledge is fully 2½ feet wide, and has been gradually opening for the last 25 feet until it now seems to be one mass of solid ore, estimated to be worth $80 for 6 feet in length and one foot deep. It looks as though, in this winze, they were on the top of a new shute or deposit of rich ore, for which this mine was so famous in its upper levels. Therefore, we think that the Superintendent is also safe in his calculations in reference to this mine, and we feel confident that, within six months, the money expended on the Elmore will be returned with handsome interest.

ORO FINO.

Not any new developments in this mine since our last report, although the drifts going south look better, and we hope again to see this mine sending out daily her 20 tons of ore.

NORTH ORO FINO.

In this mine there is no change to note this week. The ledge is large, letting out an abundance of water, and shows considerable free gold in places. Most miners are of the opinion that the North Oro Fino will prove to be a good piece of property, if developed.

EMPIRE.

The contractors are at work sinking the new shaft below the adit level as noticed in our last report. Taking a look through the old stopes we found the greater portion of them idle at present, as Superintendent MINEAR thinks he will be able to work them much cheaper and to a better advantage through his new shaft than he now could through the old one. The ledge looks well throughout and varies in size from one to two feet. The ore is high grade—decidedly the best in camp, for the quantity taken out.

WAR EAGLE.

This claim is turning out well, and shows an abundance of good ore all through. If Superintendent JOHNSON had steam hoisting works as are on most other of our mines the War Eagle, under his administration, would soon be on the dividend list. The mine is being developed as fast as possible with the limited means at Mr. Johnson's command, and we hope soon to see suitable works, believing there is pay-rock enough in sight to justify it.

Superintendent FASSETT continues drifting north in that portion of the Empire belonging to the Fimira (N. Y.) Co., and is taking out some splendid looking ore, but finds it very slow and tedious work on account of the great quantity of surface water coming in. Mr. FASSETT also ought to have steam hoisting works on his mine.

Nevada.

From the *Scientific Press* of April 13.

STARLIGHT G. & S. M. CO.

Among the numerous enterprises that have taken new life within the past few months, we are assured that none deserve the confidence of the public more than the Starlight Gold and Silver Mining Co., situated in Humboldt Mining District, Humboldt county, Nevada. The Company's property consists of three mines, located in 1862, and they have lately acquired a fourth by purchase. The company was organized in March 1863, and work commenced immediately, but in the former way of going below the mine and starting a tunnel before the mine was reached, the funds were exhausted; assessments were levied and not paid, and the property reverted to the few who located the mines, and knew their value. In February of this year, the company reorganized, and became a live company. On the first of March work was commenced on the

STARLIGHT MINE

by sinking on the lode. The shaft is now down 60 feet; they have a well-defined vein four feet in width, running north and south, nearly vertical, dipping slightly into the hill; the quartz is of a pink or rose color, and interspersed with mineral. Professor SILLIMAN examined this mine in October 1864; he reports the following:

On its out-crop, this vein is seen cutting the quartzite in which it is found—with a course in the main northwest and dipping southeast about eight degrees from the vertical. It has been opened at this place by a shaft sunk in the adjacent rock, 27 ft. deep. From the bottom of this shaft a cross cut has been run east—to cut the lode—which is here found to be five feet wide, the wall rock is feldsite. The associate minerals in the lode are free gold in small particles, with iron pyrites; also galena which is auriferous and argentiferous and a little copper pyrites and zinc blende. A sample for assay and working test which was made up from the vein stuff collected from this location, gave the following result: Gold $47.75; Silver $10.53; total, $58.29 to the ton of 2,000 lbs. A tunnel is also started, calculated to strike the vein 411 feet below the surface, and is now in 46 ft. The rock through which the tunnel was driven is a hard bluish quartzose feldsite carrying some blende, galena, yellow copper, and veins of calcareous spar.

The mine is situated within three miles of Humboldt station, on the Central Pacific Railroad, with a good wagon road to it; the canon abounds in springs, a portion of the water of which is carried to the station for the use of the railroad and irrigation. All trains stop at the station, and make the distance from San Francisco in 24 hours.

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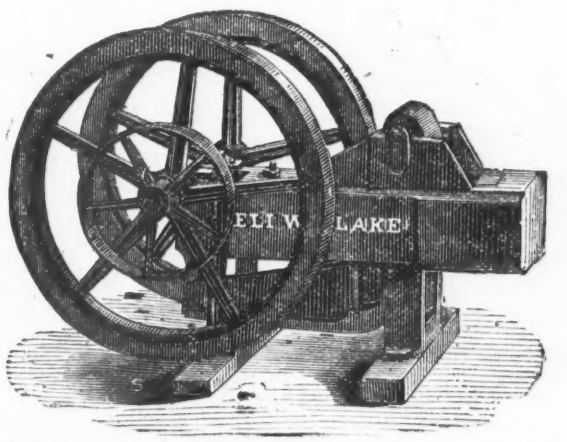

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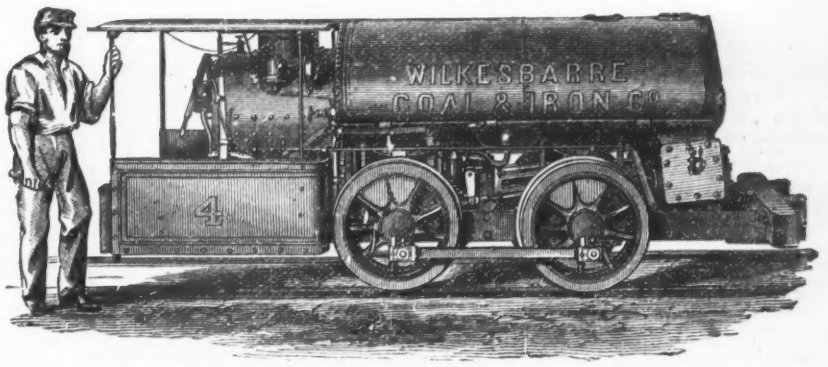

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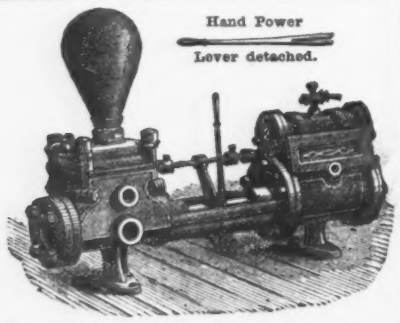

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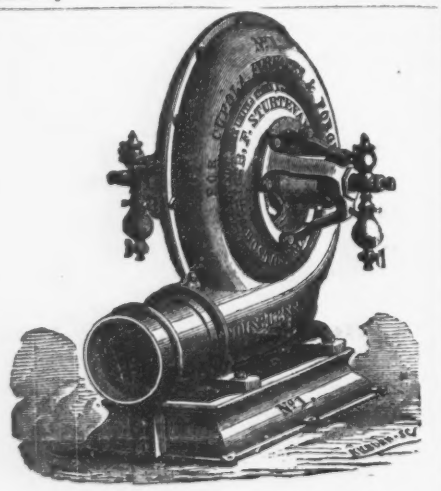

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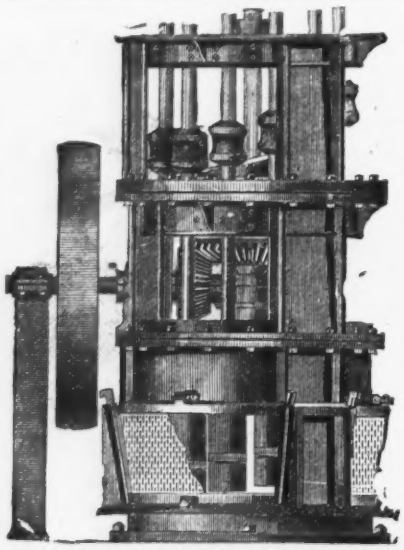

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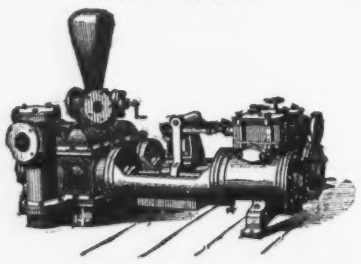

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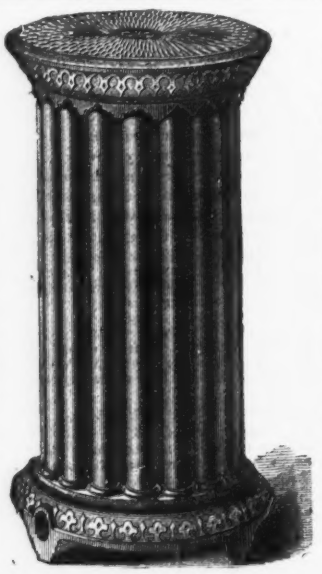

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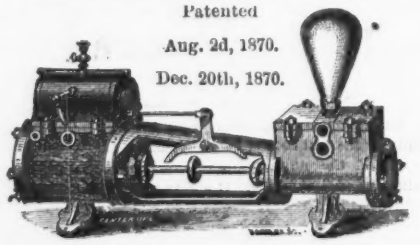

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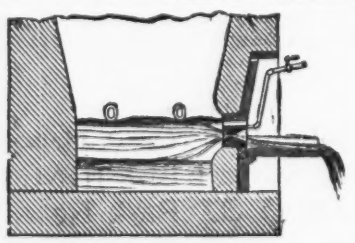

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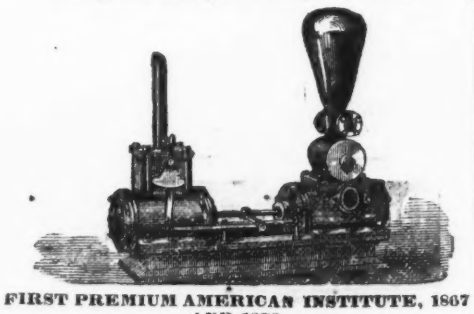

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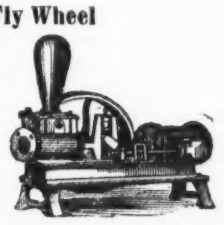

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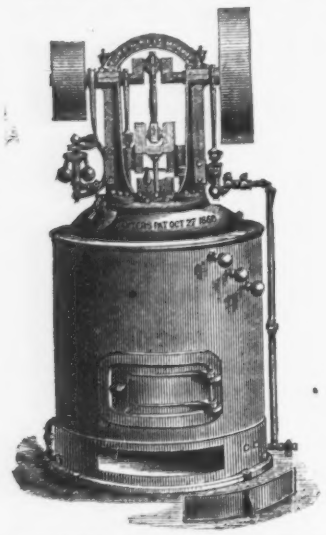

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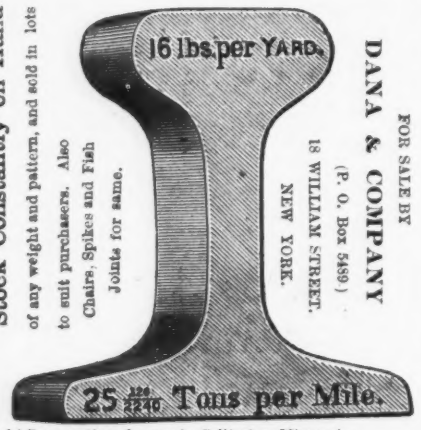

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